Welcome to the fifth in a series of articles in ACNR exploring clinical dilemmas in neuropsychiatry. In this series of articles we have asked neurologists and psychiatrists working at the interface of those two specialties to write short pieces in response to everyday case-based clinical dilemmas. We have asked the authors to use evidence but were also interested in their own personal views on topics. We would welcome feedback on these articles, particularly from readers with an alternative viewpoint.

The Purposes of Neuropsychological Assessment and How to AchieveThem

Case

Excerpt from a neuropsychological report.

… A 68-year-old, right-handed, retired man suffered from a recent stroke. The patient presented with Wernicke’s aphasia, alexia, and agraphestia, coupled with limb apraxia, right hemianopia, verbal short-term memory problems and constructional apraxia. This neuropsychological profile is compatible with a left temporo-parietal lesion. The site of the lesion had been confirmed by CT scan as a left temporo-parietal infarct at the time of admission, so what was the point of this assessment? What is the use of this technical description of the symptoms?

The remits of clinical neuropsychologists

Clinical neuropsychologists are called to investigate the impairments of higher mental functions following brain damage in individual patients. They use methods derived from experimental psychology, i.e., standardised tests requiring behavioural responses. In the dawn years clinical neuropsychologists had three main aims: to identify the cognitive deficit, to locate the associated brain lesion, and to devise suitable rehabilitation trainings. The more knowledge accrued on the complex relationship between brain structures and cognition, the less justifiable the localisation aims of the neuropsychological assessment appeared. It became clear that the alleged relationship between the performance on individual tests and the functioning of circumscribed brain areas was based on ingenuous assumptions. Moreover, the prepotent advent of modern neuroimaging techniques made this enterprise outdated, as they were able to address this same question directly without the fallacies intrinsic in the probabilistic approach which characterises neuropsychological localisation. A neuropsychological report that professes to predict the site of the brain lesion given a particular cognitive profile is unwarranted and necessarily prone to mistakes.

In parallel, the remaining two aims, which constitute the focus of modern neuropsychology, flourished, capitalising on the upsurge of cognitive modelling, which allows clinicians and researchers to account for the observed patterns of spared and impaired abilities "in terms of damage to one or more components of a theory or model of normal cognition" (p.1). In turn, this refined diagnosis consents to take an informed decision on whether or not to initiate a cognitive treatment and, if so, to make precise the targets and the working hypotheses of rehabilitation programmes. Aside from any therapeutic choice, which could be dictated by pragmatic reasons, a detailed diagnosis allows the neuropsychologist to better inform patients and carers. For example, a meticulous neuropsychological evaluation would permit to differentiate various forms of limb apraxia according to the type of gestures impaired. Different types of limb apraxia differently affect everyday activities; problems with intransitive gestures affect gestural communication, difficulties in carrying out transitive gestures affect object manipulations, whereas deficits of unfamiliar gestures affect rehabilitation exercises requiring imitation.

Furthermore, a sound neuropsychological diagnosis will allow the consultants in charge of the patients to advise them and their carers on daily activities, such as renewing the driving licence or suitability to specific jobs.

The role of clinical neuropsychologists

To achieve the above aims, neuropsychologists use relatively simple tasks, such as reading aloud, drawing, recognising objects, or memorising lists of words, and are equipped with off-the-shelf tests or pre-packed test batteries. The apparent simplicity of the neuropsychologist’s trade-mark instruments is deceptive. The core competence of a neuropsychologist is not solely to administer the tests (which could be presented by different professionals), but to plan the individual assessment, to refine the testing programme, to decode the findings, and to unravel the observed pattern of performance. Central to their remit is the interpretation of the outcome from such tests, based on both accuracy scores and the qualitative analysis of errors. Like a radiologist who could carry out a scan, but whose main chore is to interpret it, the neuropsychologist is asked to derive hypotheses on the patient’s cognitive functioning. Hence, the diagnostic process should not be merely applying gross clinical labels (i.e. Broca’s aphasia, dysexecutive syndrome, unilateral neglect,
episodic amnesia), but to identify the damaged component(s) of the cognitive processes in individual patients.

The neuropsychological interpretation

A single error is per se opaque. Take a patient who reads the word "deer" as "beer"; this error could be classed as letter substitution, but it could be interpreted by means of five different accounts. The error could be (i) perceptual (d → b), revealing a problem in coding the spatial orientation of the letter shape, which will involve also non-orthographic stimuli; (ii) orthographic (dDS → bDS), due to a deficit in processing the letter identity; specific to reading tasks; (iii) lexical-semantic (deer → beer), because of the selection of another lexical unit which could be semantically related (like in beer-beer root beer or in Beer Deer or Beef-Beer Road); (iv) for it to be classed as semantic paraphasia, does not necessarily involve also non-orthographic stimuli; (v) attentional (deer → euer), due to a defective coding of the beginning letter, as in neglect dyslexia. The ambiguity of single errors needs to be acknowledged that a poor labelling of an error, like "letter substitution", can be classed as letter substitution, but it could be traced to a pre-semantic deficit, as in associative agnosia, or it could result from a post-semantic deficit, as in anomic aphasia.3

Psychometrics is not all

Good tests are furnished with norms, which allow the identification of performances that deviate from psychometric values like the median, or the lower 5th centile, relative to validated cut-off scores derived from a reference sample. These arbitrary criteria can give rise to false positives or false negatives, which could be avoided by acknowledging that a poor performance does not necessarily equate to a pathology.

To assess a given cognitive function one single test cannot suffice, as the test-function correspondence is weak. The 'Token Test' is recognised as a good test to assess language comprehension, yet it includes only a limited number of lexical units (names of shapes and colours) and does not assess linguistic processes like inferential knowledge ("I heard a dog" conveys the information that the dog is barking) and the assignment of thematic roles (the role of agent is assigned to nouns occupying pre-verbal and post-verbal positions in active and passive sentences, respectively).

Moreover, there are several different ways to fail a test. A patient may fail the Token Test, not because of aphasia, but because of colour agnosia or a working memory problem in binding shapes to colours, or in keeping track of the word sequence. Moreover, the validity of a test should not be taken for granted. A test might not assess exactly what it was devised for, because of faulty selection of the stimuli. The Judgement of Line Orientation Test, widely assumed to detect selective visuo-spatial deficits in right hemi-agnosia patients, is biased by an uneven distribution of the stimulus lines, which are easier to discriminate in the left space.4

Structure of the neuropsychological assessment

A sound neuropsychological assessment should adopt the four of the latter step, interwihch the neuropsychologist begins with the interview aimed at gathering a targeted personal and clinical history, in order to isolate and contextualise the problem(s). The context within which the complaint arises is relevant as it allows the clinician to ascertain whether other, non-neuropsychological factors (e.g., familiar socio-economic professional) may play a causal role. This should be followed by a screening phase, whereby a comprehensive battery of brief tests is given.5,6 The purpose of this step is twofold. On one hand it confirms the existence of the stated problem, on the other it informs further, deeper, investigations by revealing expected errors as well as flagging unexpected hints. Limiting the examination to this level would only attain the scope of corroborating the problem as lamented by the patient and their carers, perhaps by labelling it more eloquently, like a doctor diagnosing a knee pain as gonalgia. The third step encompasses a full-blown neuropsychological examination: a thorough overview of the information gleaned with the preliminary steps. Here the neuropsychologist’s tests are tests or batteries geared at investigating the presence and the severity of specific disorders,7,8 by means of which one could reach a clinical labelling. The diagnostic process should not stop at this stage, as clinical labels cover a wide range of cognitive disturbances lumped together under a syndromic umbrella. For example, three different forms of developmental surface dyslexia have been described9-10 or multifarious phenomena of neglect have been reported.11 To identify the precise locus of cognitive impairment is the objective of the latter step to which the neuropsychologist should use experimental tests, culled from the literature, or even devised ad hoc.

Conclusions

The use of the neuropsychological evaluation as a tool to localise the cerebral lesion has become largely redundant owing to the development of modern neuroimaging techniques. The use of standardised batteries is still helpful to classify patients according to widely accepted clinical taxonomies. However, to move forward the clinical management of an individual patient, a more detailed evaluation is needed.

The neuropsychological evaluation can come to an end when the full picture of spared and impaired cognitive mechanisms of the individual patient is specified. Even if the instruments used by the neuropsychologists are deceptively simple, as any other diagnostic procedure, the interpreta- tion of their outcome requires considerable expertise which only a psychologist trained in clinical neuropsychology is able to offer. The assessment of the consequences resulting from brain damage is incomplete without a thorough neuropsychological examination, as this will better the need of the patient.

In the case above, a detailed neuropsychological assessment allows going beyond any clinical label or meaningless list of symptoms and provides useful information to plan a rehabilitation program tailored upon the specific deficits shown by the patient. Instead of naming the deficit (for instance, by using the word “alexia” which means “inability to read”) and adopting a fixed set of exercises to be applied to all patients belonging to the same vague category, the treatment approach requires detailed hypotheses concerning the impaired linguistic and cognitive mechanisms in order to plan an effective strategy. Indeed, only the correct identification of the underlying cause(s) of the functional deficit allows choosing the most achievable goal of the treat- ment, either the restoration of the damaged mechanisms or the enhancement of the spared processes or the everyday managing of the impaired behaviour.♦

REFERENCES

7. Benton AL, Varney NR, Hamsher, K. A neuropsychological instrument adding to the description of the deficit (for instance, by using the word "alexia", which means "inability to read") and adopting a fixed set of exercises to be applied to all patients belonging to the same vague category, the treatment approach requires detailed hypotheses concerning the impaired linguistic and cognitive mechanisms in order to plan an effective strategy. Indeed, only the correct identification of the underlying cause(s) of the functional deficit allows choosing the most achievable goal of the treatment, either the restoration of the damaged mechanisms or the enhancement of the spared processes or the everyday managing of the impaired behaviour. 


ACNR > VOLUME 11 > NUMBER 1 > MARCH-APRIL 2011 > 37