5. A Case Study of Strategic Infarct Dementia Investigated with the Cognitive Assessment System

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Two subjects with brain lesions who were matched on demographic variables were tested on the Cognitive Assessment System (CAS). AK had been dependent on caregivers after a frontal aneurysm 6 years previously despite intact receptive and expressive language skills and motor functions. GM sustained multiple infarcts although he continued to function well on his own. Nonparametric analysis showed that AK's T scores on CAS subtests were lower than that of GM's based on a comparison with a heterogeneous group of brain-damaged patients ($p < .003$). The CAS's broad range of complexity of items within subtests, apparent sensitivity in differentiating rates of cognitive decline in dementia, and convergence with dementia rating scales suggests that it could be useful for assessment of strategic infarct dementia.

Report

The CAS is a test of performance competencies based on cognitive and neuropsychological theory in addition to its psychometric operationalization (Naglieri, 1999). The CAS incorporates tests of planning and attention specifically designed for use with children and adolescents. Adoption of a cognitive strategy is the most efficient means of completing the planning tasks while the attention tasks purportedly tap behavioral inhibitory and vigilance capacities. The simultaneous scale consists chiefly of visuospatial perceptual and reasoning tasks with the exception of *Verbal–Spatial Relations* that has both verbal and visuospatial features. In contrast the successive scale consists of verbal memory, repetition, and comprehension tasks.

Some of the CAS tasks such as *Matching Numbers* are unique while other tasks are common derivations of adult neuropsychological tasks well normed for 5- to 18-year-olds. Briefly, *Matching Numbers* is similar to Teuber's visual search tasks used for assessing symptoms of frontal dysfunction. *Planned Codes* is similar to the Wechsler scale's coding subtests (e.g., symbol search) but in the CAS version adoption of a specific strategy optimizes efficiency of completion. *Planned Connections* is almost identical to the commonly employed Trail Making Tests A and B. The Attention Scale consists of *Expressive Attention* that is virtually indistinguishable from the classic Stroop Test; *Number Detection* that is similar to many Line Cancellation tests; and *Receptive Attention* that is modeled on Posner's lexical and physical identity match tasks.

The simultaneous scale consists of *Nonverbal Matrices* that is modeled on the Raven's Progressive Matrices; *Verbal–Spatial Relations* that is similar to the Tokens Test; and *Figure Memory* that is similar to Memory-for-Designs test. The successive scale consists of *Word Series* which is similar to other digit or word span tasks; the *Sentence Repetition* test which is like other sentence repetition tasks except that in the CAS version the sentences are semantically meaningless so as to emphasize syntactic processing. In *Sentence Questions* the examinee must rely on the serial positions of words within sentences to correctly answer the prompts since as with the *Sentence Repetition* test the cue sentences are semantically meaningless (see Naglieri, 1999, for a complete description of these tasks).

In the context of neuropsychology the CAS's planning and attention tasks have been shown to be effective for assessing executive dysfunction in a sample of traumatic brain injured children (see Naglieri, 1999). Also relevant is an earlier study by Das et al. (1995) comparing the performance of young and old groups of Down syndrome (DS) subjects to that of young and old groups of IQ-matched non-DS subjects. Subjects were tested on the Peabody Picture Vocabulary Test—Revised (PPVT-R), Mattis Dementia Rating Scale (MDRS), and the CAS (see Spreen & Strauss, 1998). Older individuals with DS (age range 50 to 62 years) performed worse than the other three groups on the PPVT-R, MDRS, and the CAS when using Wechsler or Stanford-Binet IQ as a covariate. Moreover, in the DS old individuals in whom there is a propensity for development of disease of the Alzheimer's type (DAT) baseline IQ scores and MDRS scores were substantially correlated whereas in the young DS group these scores were not correlated. Together these results suggest that cognitive changes associated with DAT common in older persons with DS appear to be readily detectable with the CAS scales and individual subtests. Almkvist et al. (1996,

p. 47) have concluded that there is a ". . . need for multifunctional assessment of moderate to severe dementia free from both floor and ceiling effects . . ." for the purposes of diagnosis, rehabilitation, and assessment of effects of pharmacological treatment of dementia. This descriptive case study sought to determine whether the CAS might also be useful in the context of the neuropsychological assessment of vascular dementia, specifically strategic infarct dementia.

Single infarct stroke patients (*N* = 14) ranging in age from 50 to 64 years (mean 55) were the comparative group from which were derived *T* scores for AK and GM. All patients were tested between 2 weeks and 1 month postadmission to the stroke unit. Patients AK and GM were matched for age, sex, education, ethnic grouping, occupational attainment, and region using the Barona Index of premorbid ability (Spreen & Strauss, 1998, p. 47). Both patients' level of premorbid ability (VIQ) was estimated at between 87 and 111 at 15% confidence intervals. AK and GM were each assessed on the Mini-Mental Status Exam (MMSE) within days of the CAS assessment. AK's MMSE score of 20 was in the impaired range compared to noncognitively impaired elderly patients with 8 or less years of education between the ages of 65 and 79 (5th percentile). The positive predictive power of the MMSE in discriminating Alzheimer patients from age-matched normal elderly patients at a criterion MMSE score of 20 has been previously shown to be 67% (Spreen & Strauss, 1998, pp. 71–72). GM's MMSE score of 28 was in the average range for his age grouping.

AK. Extensive cortical and white matter disease involving the superior and middle gyri of the left frontal lobe as well as the orbital gyrus and gyrus rectus of the right frontal lobe is noted. Cortical disease also extends to the inferior gyrus of the left temporal lobe. There is subcortical white matter disease involving the inferior

TABLE 1

Raw Scores for the Comparison Group (*N* = 14); Raw Scores for the Heterogeneous Brain-Damaged Group (*N* = 16) Including the Two Case Studies (Age Range = 50 to 67, *x* = 57); *T* Scores for Two Case Studies Based on the Comparison Group; and Difference Values in *T* Scores between the Two Cases

CAS subtests & COMPOSITE SCALE	Mean (SD) raw scores (*N* = 14)	Mean (SD) raw scores (*N* = 16)	Patient AK MMSE = 20 (Age 65 years)	Patient GM MMSE = 28 (Age 67 years)	Difference values in *T* scores
Matching Numbers	8 (5)	8 (5)	43	58	14
Planned Codes	41 (23)	37 (24)	35	38	4
Planned Connections	349 (221)	355 (209)	43	52	9
PLANNING	—	—	40	50	9
Expressive Attention	35 (16)	32 (17)	31	37	7
Number Detection	38 (28)	36 (27)	47	45	−1
Receptive Attention	32 (18)	30 (18)	38	46	8
ATTENTION	—	—	38	43	4
Nonverbal Matrices	15 (9)	14 (9)	40	45	6
Verbal Spatial	17 (5)	16 (5)	40	45	6
Relations	11 (6)	11 (6)	37	46	9
Figure Memory	—	—	39	45	7
SIMULTANEOUS					
Word Series	12 (3)	11 (3)	24	43	19
Sentence Repetition	10 (3)	9 (3)	29	40	12
Sentence Questions	12 (3)	11 (3)	29	33	4
SUCCESSIVE	—	—	27	39	11
FULL-SCALE	—	—	36	44	8

gyrus of the left frontal lobe. As well, there is disease of the head of the left caudate nucleus and anterior portions of the left globus pallidus and putamen. There is deep white matter disease involving the left internal and external capsules. These gliotic changes are the result of an intracranial aneurysm 6 years previously.

GM. There is subcortical white matter disease involving the left centrum semiovale and subcortical white matter of the left parietooccipital lobe due to an oligodendroma tumor excision 5 years prior. There is a new finding of subtle cortical and white matter disease involving the right parietal lobe (see Table 1).

A nonparametric Wilcoxon signed-rank test demonstrated GM's performance on the 12 CAS subtests was significantly higher overall compared to AK ($z = 2.981$, $p < .003$), for a two-tailed test. Although assumptions regarding normality of distributions of scores within subtests were violated, there are a number of trends worthy of comment between AK and GM. GM's performance on the verbal scale of *Word Series* appeared to be significantly better than that of AK. In addition, of note were the consistently lower performances on the successive scale in AK compared to GM. *Matching Numbers* also appeared to discriminate between these two subjects. The MMSE, neurologists' reports, observational data, history, and neuroradiological findings are consistent with strategic infarct dementia as a sequalae of left caudate and globus pallidus infarction and extensive damage to the left frontal lobe in AK (McPherson & Cummings, 1996). The results suggest the CAS is useful in the context of neuropsychological assessment of strategic infarct dementia. It remains to be determined whether the CAS also demonstrates neuropsychological sensitivity and specificity at the subtest level (e.g., localizing properties) and if it would provide useful information in this respect beyond that offered by existing neuropsychological batteries.

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REFERENCES

Almkvist, O., Brane, G., & Johanson, A. (1996). Neuropsychological assessment of dementia: State of the art. *Acta Neurologica Scandinavia,* **Suppl. 168,** 45–49.

Das, J. P., Davis, B., Alexander, J., Parrila, R. K., & Naglieri, J. A. (1995). Cognitive decline due to aging among persons with Down syndrome. *Research in Developmental Disabilities,* **16,** 461–478.

McPherson, S. E., & Cummings, J. L. (1996). Neuropsychological aspects of vascular dementia. *Brain and Cognition,* **31,** 269–282.

Naglieri, J. A. (1999). *Essentials of CAS assessment.* New York: Wiley.

Spreen, O., & Strauss, E. (1998). *A compendium of neuropsychological tests: Administration, norms and commentary* (2nd ed.). New York: Oxford University Press.

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