Predicting Dementia of the Alzheimer Type Using Cognistat

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Although not as extensively studied or widely used as the Mini Mental State Examination, Cognistat may be a more sensitive tool for cognitive evaluation in elders. These investigators propose Cognistat subscale cutoff scores for differentiating DAT from other types of cognitive impairment in veterans.

Dementia is a generic term used to characterize the development of multiple cognitive deficits that impair such intellectual abilities as language, abstract reasoning, and memory, while affecting a person's relational or occupational functioning. Dementia can be caused by a number of physiological conditions, including neurodegenerative, vascular, traumatic, toxic, or infectious etiologies.

Dementia of the Alzheimer type (DAT) is the most common form of dementia and is characterized as a progressive neurodegenerative process, with age identified as the single most important risk factor.[1] A recent report compiled by the VA's Office of the Assistant Deputy Under Secretary for Health projected that the prevalence of dementia in veteran enrollees aged 65 and older will rise from 218,455 in 2004 to a peak of 339,248 in 2015—a remarkable 55% increase in just over a decade.[2] Therefore, dementia is and increasingly will be a major health problem for our aging society, including our veteran population.

Cognistat, also referred to as the Neurobehavioral Cognitive Status Examination, is a testing instrument used to screen for and differentiate between a variety of cognitive disorders, including dementia.[3–8] It provides basic information about a patient's executive system functioning (through measures of attention and abstract reasoning), as well as information on domains characteristically affected by dementia. Cognistat has been identified as a useful instrument in screening for cognitive impairment in elderly inpatient and outpatient populations, including those with dementia or dementia-like symptoms.[7,9]

Studies have suggested that Cognistat profiles also can be used to differentiate between various cognitive disorders. For example, Margolin and colleagues suggested that patients with Parkinson disease have significantly different Cognistat profiles than patients with DAT.[10] In addition, the authors of Cognistat provided case studies depicting the profiles associated with various cognitive disorders,[11] though there is little systematic research regarding the derivation of these profiles.

Since screening for dementia is as important as ever, having implications for both clinical care and future research, we conducted a study to develop Cognistat cutoff scores that would maximally differentiate DAT from other forms of cognitive impairment in a veteran population. In completing this analysis, our overall goal was to help establish a dementia-specific "fingerprint" that practitioners could further use to identify those veterans in need of a more comprehensive evaluation.

COGNISTAT AS A SCREENING TOOL

Cognistat evaluates five major domains of cognitive functioning—language, construction, memory, calculation, and reasoning abilities—and, with separate measures, assesses levels of consciousness, orientation, and attention. The 25-minute screening test generates a profile of cognitive abilities, rather than one global score,[11,12] and it is designed so that a patient's successful performance in several cognitive domains does not obscure deficits in others. The scoring system calculates values, ranging from 0 to 12, for each cognitive domain. Memory domain scores, for instance, are based on the unprompted, delayed recall of four everyday words.[13]

Data on normal Cognistat values have been developed for a variety of populations, including children,[14] healthy adults,[11] healthy elders,[15,16]

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and neurosurgery patients.[17] Data from healthy elders and neurosurgery patients suggest age-specific declines in memory and construction ability.[15,16]

Several studies have shown that Cognistat has good sensitivity and specificity in predicting organic brain impairment[18] and moderate overall validity in screening for cognitive impairment.[19] Other studies have suggested that it has good sensitivity but relatively lower specificity than other screening measures.[13,20,21]

Compared to the Mini Mental State Examination (MMSE),[22] the most widely used cognitive screening test, Cognistat has been found to have a higher sensitivity in geriatric populations, specifically for orientation and memory.[21] In addition, Cognistat's individual scores for a variety of cognitive domains provide more information about particular areas of possible cognitive decline than the one overall score of the MMSE, which may obscure deficits in specific cognitive domains.

STUDY DESIGN

To identify Cognistat subscale cutoff scores for dementia, we retrospectively evaluated the Cognistat profiles of veterans diagnosed with DAT and those diagnosed with other forms of cognitive impairment. Testing protocols were selected randomly from neuropsychological assessment cases at the VA Central California Health Care System's Fresno psychology section. Cognistat was administered as part of a standard neuropsychological evaluation, and diagnoses were made as part of routine assessments during which other patient data (such as additional cognitive measures, medical history, and behavioral observations) were considered as well. All testing was administered by graduate level psychology students.

Table 1. Initial and final, adjusted Cognistat cutoff scores determined to maximize sensitivity for dementia of the Alzheimer type

Cognistat domain	Initial score	Final, adjusted score
Orientation	< 12	< 11
Attention	> 5	> 4
Comprehension	> 4	> 2
Repetition	> 9	> 7
Naming	5–8 (inclusive)	3–8 (inclusive)
Construction	1–5 (inclusive)	0–5 (inclusive)
Memory	< 6	< 6
Calculation	> 1	> 1
Similarities	3–8 (inclusive)	2–8 (inclusive)
Judgment	> 3	> 2

Establishing the DAT and Non-DAT 1 patient groups

During the first phase of our research, we established our DAT group. These 20 patients had been diagnosed with DAT, using criteria from either the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* or the National Institute of Neurological and Communicative Disorders and the Stroke-Alzheimer's Disease and Related Disorders Association. This group included only patients diagnosed with DAT who had no additional psychiatric disorders or other neurologic diagnoses. The average age of these patients was 78.2 years (range, 67 to 87 years). The group consisted of 20 patients, 16 men and four women, and all had been referred for routine neuropsychological evaluations. The average years of education for these group members was 11.1 (range, seven to 14 years).

We then established our non-DAT 1 group by selecting 20 patients who did not meet the criteria for DAT but who had been diagnosed, through the MMSE, with mild to moderate forms of other cognitive disorders. (These disorders included vascular dementia, mild cognitive impairment, and Parkinson disease.) The patients' average age was 66.9 years (range, 25 to 79 years), all were male, and all had been referred for routine neuropsychological evaluations. The average years of education for the group was 12.3 (range, five to 15 years).

Only patients who had MMSE scores greater than 20 (indicating overall mild or moderate cognitive impairment) were included in the DAT group and the non-DAT 1 group, because more advanced stages of dementia are associated with significant impairment across multiple areas, and such deficits in performance would be below the lower limit of inclusive Cognistat scores.

Identifying the subscale cutoff scores

Next, we established Cognistat subscale criterion scores that would maximally distinguish the DAT group from the non-DAT 1 group patients. Our initial cutoff scores for each domain were derived a priori, based on clinical experience.

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Because early-stage DAT typically presents with disproportionate memory impairment and only mild overall cognitive deficit, we chose memory and orientation domain cutoffs to select for low scores, or those ranging toward the lower limit. We devised cutoffs for other measures to select for scores ranging toward the upper limit. We entered the cutoff scores into a database that assigned study participants to either the DAT or the non-DAT 1 group, and by successive adjustments of cutoffs, we maximized the specificity and sensitivity of the cutoff scores (Table 1).

The age-matched non-DAT group

During the second phase of our research, we established a second control group—the non-DAT 2 group. We selected members of this group using the same criteria as the non-DAT 1 group, except that non-DAT 2 group members were age-matched (within 12 months) to the members of the DAT group. The non-DAT 2 group consisted of 20 participants with an average age of 78.2 years (range, 67 to 87 years). All participants were male and had been referred for routine neuropsychological evaluation. These group members had an average of 10.7 years of education (range, six to 18 years).

Our final step was to assess the utility—including specificity, sensitivity, and positive predictive value—of our established Cognistat subscale criterion scores on members of the non-DAT 2 group. We used the adjusted Cognistat cutoff scores to assign the DAT and non-DAT 2 group participants into DAT and non-DAT groups. We then determined the specificity, sensitivity, and positive predictive value of these cutoff scores. Individual items from the Cognistat were examined post hoc to determine their individual contributions to group differentiation.

RESULTS

Using the non-DAT 2 and the DAT study groups, a chi-square test for independence was used to assess whether the established Cognistat cutoff scores could predict DAT accurately. None of the cell sizes had a minimum expected count of less than five. The Pearson chi-square test results were significant (χ^2 [1, n = 40] = 17.3, $P < .01$). The levels of sensitivity and specificity reached using the cutoff scores were 75% and 90%, respectively (Table 2). The positive predictive value, or the likelihood of a patient actually having DAT given a positive result, was 88%.

The single Cognistat domain cutoff that showed the greatest ability to differentiate correctly between DAT and non-DAT 2 patients was memory. The memory domain alone produced a significant chi-square value (χ^2 [1, n = 40] = 21.5, $P < .01$), and it achieved 100% sensitivity (Table 3). Using the memory domain cutoff alone, however, resulted in much lower specificity and positive predictive values: 70% and 77%, respectively.

Table 2. Classification of study patients as having or not having DAT* using the established Cognistat cutoff scores

Study group	Group assignment†	
	Patients with DAT	Patients without DAT
DAT group (n = 20)	15 (75%)	5 (25%)
Non-DAT 2 control group (n = 20)	2 (10%)	18 (90%)

*DAT = dementia of the Alzheimer type. †χ^2 (1, n = 40) = 17.29, $P < .01$.

GOOD SENSITIVITY DESPITE LIMITATIONS

Our results, which suggest that Cognistat has fairly good sensitivity in differentiating DAT from other types of cognitive impairment in veterans, are consistent with previously published research. In addition, our data revealed strong specificity and a high positive predictive value, suggesting that the use of cutoff scores derived from clinical experience improved the sensitivity and predictive validity of Cognistat. This relatively impressive result may have been due to the small sample size or the inclusion of only male veterans who had been suspected of having cognitive failure.

Despite limitations in our methodology, however, our data nonetheless provide compelling evidence that Cognistat is worth studying as a dementia-specific, brief cognitive examination tool. The multiple and quantifiable subtests (some of which have age-corrected normative data) and differential profile generated across patient groups holds particular promise. In our current research, specifically setting the memory and orientation domain subtest cutoffs toward the low end of the scoring scale is consistent with the pattern of cognitive deficits typically associated with early-stage DAT. Indeed, this is demonstrated in our impressive finding that, when using the Cognistat memory subtest cutoff scores alone, sensitivity was perfect and overall predictive value was fair. In other words, Cognistat appears to be potentially

Table 3. Classification of study patients as having or not having DAT* using the established Cognistat memory domain cutoff alone

Study group	Group assignment†	
	Patients with DAT	Patients without DAT
DAT group (n = 20)	20 (100%)	0 (0%)
Non-DAT 2 control group (n = 20)	6 (30%)	14 (70%)

*DAT = dementia of the Alzheimer type. †χ^2 (1, n = 40) = 21.5, $P < .01$.

useful in producing dementia-specific patterns, at least for DAT.

SUGGESTIONS FOR FUTURE RESEARCH

The U.S. Preventative Services Task Force recommends cognitive evaluation for any individual exhibiting symptoms consistent with dementia or other cognitive impairment.[23] Using a screening measure such as Cognistat to detect dementia-specific patterns is not a new idea,[8] and it is not meant to replace conventional clinical practice for the diagnosis of cognitive disorders. Refining the usefulness of currently available screening tools, however, likely would be of benefit in the clinical and research settings. Accordingly, we suggest that prospective, VA population-based studies using Cognistat be undertaken. We recommend methods that control for age, psychiatric disorders, and active substance abuse; include all dementia severity levels; and include all patient populations (not only those patients already suspected of having a cognitive disorder) randomly. ●

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