COGTEST Identifies Impairment in Multiple Memory Domains in Age Associated Memory Impairment

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Abstract

Background: Performance on memory tests have been used to identify individuals with age associated memory impairment (AAMI). However, the extent to which different memory domains are affected is not readily known. We examined verbal, visual, and working memory performance in individuals with AAMI (n=146) to determine if a domain specific or generalized memory performance deficit exists, compared to normal aging peers (Healthy Controls (HC); n=50). Further we examined the utility of Cogtest, a computerized cognitive testing battery, to identify memory impairment in AAMI. Several subtests from the Cogtest library, including the Word List Memory Test (verbal selective reminding memory test), Face Memory Test (visual memory), and the Auditory Number Sequencing Test (working memory) were administered. We hypothesized that only the verbal memory domain would show group differences.

Methods: Subjects received a screening battery which included a paired associate test that was used to objectively define AAMI (-1 SD) compared to HC. Group differences were found for education and this was covaried in all analyses. ANCOVA was used for data analysis and the significance level was set at p < .01.

Results: Significant group performance differences were seen for all measures of the Word List Memory Test. Compared to controls, AAMI subjects remembered significantly fewer words on the first trial (mean's = 9.2 and 7.1, respectively), on all trials (mean's = 54.3 and 45.7, respectively), and after a 30 minute delay (mean's = 12.8 and 9.6, respectively). In addition, significant Face Memory Test group effects were found (p's ≤.001), with AAMI subjects remembering significantly fewer faces (73%) than HC (78%). After a 30 minute delay, AAMI subjects remembered significantly fewer faces (67%) compared to HC (73%). In the Auditory Number Sequencing task, while the AAMI sequenced fewer numbers (mean = 11.4) compared to HC (mean = 12.2), this did not reach significance (p > .10).

Conclusions: We conclude that multiple memory domains are affected in AAMI. Individuals with AAMI show deficits in verbal and visual memory compared to adults without evidence for age-related memory changes. This study shows that the Cogtest library of tests is able to identify cognitive deficits in AAMI subjects.

Introduction

Age Associated Memory Impairment (AAMI) has been used as an objective way of defining cognitive decline with ageing. The concept, developed by Crook et al. in 1986[1], has well-defined criteria. AAMI was originally developed to refer to a subpopulation of normal older individuals[1], but there is evidence to suggest that it may be a discrete entity, showing significant brain and behavioral changes compared to normal ageing[2,3,4]. The purpose of this study was to examine the extent to which memory is affected in AAMI using *COGTEST*.

Method

We examined verbal, visual, and working memory performance in 146 subjects with AAMI to determine if a domain specific or generalized memory performance deficit existed. Classification of AAMI was based on the following criteria:
(1) age above 60; (2) memory test performance 1 standard deviation below the mean established for young adults; (3) complaints of memory loss; and (4) adequate intellectual functioning. Exclusion criteria were medical and psychiatric conditions that could produce cognitive deterioration, such as stroke, inflammatory brain diseases, delirium, depression, history of alcoholism. Moreover, people taking medications which could contribute to impair cognitive performance, such as psychotropic or anticholinergic drugs, were excluded.

	AAMI	CONTROL
AGE	66 yrs	64 yrs
EDUCATION	12 yrs*	13 yrs
% ♀	57%	74%
% WHITE	98%	100%

* p < .05

Cognitive Assessment

Cognitive function was assessed with *COGTEST*, a customized computerized cognitive test battery (Cogtest, Inc. DE) designed for use with a variety of clinical populations and in clinical trials. The platform allows for accurate recording of reaction times and enhanced standardization of administration relative to conventional paper-pencil tests.

Auditory Number Sequencing (attention, working memory, executive functions): Subjects hear a series of numbers (e.g. "9.. 3.. 6"; minimum=2 digits, maximum=8 digits) and are asked to repeat the numbers in order, from lowest to highest, requiring both working memory maintenance and manipulation.

Word List Memory (verbal memory): The WLM is an auditory-verbal recall test using a selective reminding paradigm. Subjects are asked to recall as many as possible of 16 words that have been auditorily presented by the computer. On the second trial, the computer repeats only those words that subjects have not recalled and subjects are then asked to try to recall all 16 words again. The process is repeated up to five times total and there is a 30 minute delay trial.

Face Memory Test (visual memory): Subjects see a series of 40 computer-generated faces (3 sec. exposure each), then have to recognize the face seen before in 40 forced choice trials. The delay phase of the test is administered after 30 minutes.

Auditory Number Sequencing
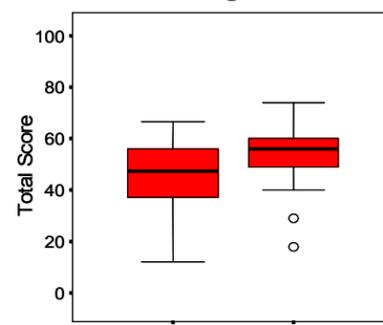
Face Memory

Word List Memory

Statistical Analysis

To evaluate cognition, we compared performance on the 3 cognitive tests using an analysis of covariance. Education was significantly different between groups and controlled for in all analyses. Significant between-group main effects were submitted for post hoc testing using both Tukey HS tests. Statistical significance was declared at the .01 level (two-tailed).
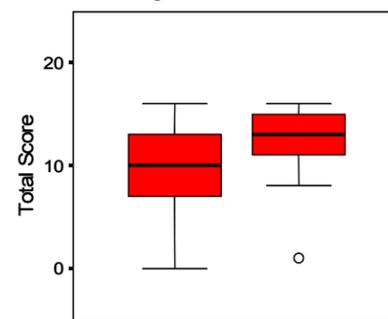
Results

AAMI group had significantly lower scores on the word list memory test and the face memory test but not the auditory number sequence task.
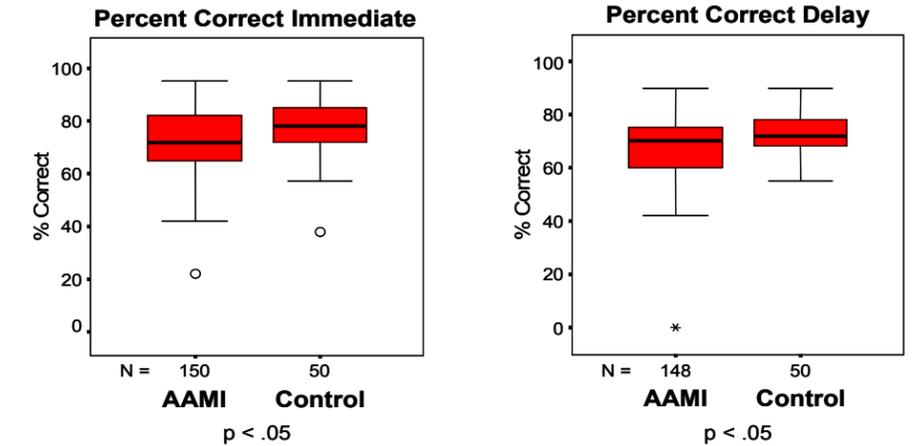

Total Learning Over 5 Trials

N = 146 (AAMI) / 50 (Control) — p < .001

**Delayed Recall Correct**

N = 145 (AAMI) / 50 (Control) — p < .001

Visual Memory:
The AAMI group remembered significantly fewer faces immediately following presentation, and after a 30 minute delay.

Percent Correct Immediate

N = 150 (AAMI) / 50 (Control) — p < .05

Percent Correct Delay

N = 148 (AAMI) / 50 (Control) — p < .05

Auditory Working Memory:
AAMI group sequenced fewer numbers than the control group, however this did not represent a significant group difference.

Total Correct

N = 148 (AAMI) / 49 (Control) — n.s.
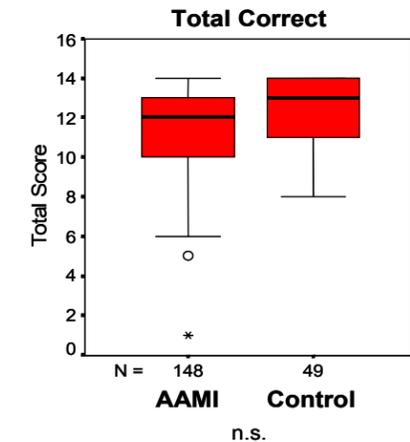
Conclusion

Impairment in verbal and visual memory but not in working memory domains in AAMI compared to control subjects was seen. The *COGTEST* library of tests can be used to identify cognitive deficits in AAMI.

References

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