

Comparison of Aphasic Patients and Demented Patients Using a Group of Neuropsychological Tests

Yoko Fukusako, Toshiko S. Watamori*,
Hisako Monoi** and Sumiko Sasanuma*

Introduction

In the field of speech pathology, it is important to differentiate aphasia from dementia, since the method of intervention as well as prognosis is different between the two conditions. However, it is not an easy task to differentiate aphasic patients from demented patients particularly in the aged population, since the etiology (cerebrovascular accidents) as well as the symptomatology (communication disorders) is common between the two conditions.

Although differences in performance for linguistic tests between aphasia and dementia have already been identified (Rockford, 1971; Halpern, et al., 1972), systematic research on the problem has begun only recently. Various measures have been used in studying the difference between the two diagnostic groups with reference to specific aspects of language functions such as naming (Rockford, 1971; Nicholas, et al., 1985; Huff, et al.; Stevens, 1988), reading comprehension, paraphasia, calculation, fluency (Halpern, et al., 1972; Deal, et al., 1981), and discourse tasks (Nicholas, et al., 1985). More comprehensive aspects of linguistic and communicative functions are investigated using established aphasia test batteries. For example, Appell et al. (1982) used the Western Aphasia Battery (WAB), Watson & Records (1978) and Wertz (1982) used the Porch Index of Communicative Ability (PICA), Emery (1988) used the Boston Diagnostic Aphasia Examination (BDAE), Boone & Bayles (1985) used the Linguistic Communication Battery, and Fromm & Holland (1989) and Watamori, et al. (1989) used the Test for Communicative Abilities for Daily Living (CADL). Studies using comprehensive neuropsychological tests covering not only the linguistic and communication abilities but also memory, visuospatial perception and other behavior have been emerging: Bayles & Kaszniak (1987) and Bayles, et al. (1989) used the Arizona Battery for Communication Disorders (ABC) of Dementia in differentiating aphasia from dementia. Although all these reports except one (Halpern, et al., 1972) pointed out the differences between aphasia and dementia in terms of patterns of the test performances, only a few studies addressed the comparison between each of different types of aphasia and dementia. Among those Nicholas, et al. (1985) examined anomia and Wernicke's aphasia using a picture-description task, Boone & Bayles (1986) investigated the difference between dementia and anterior and posterior aphasia using the linguistic communication battery and Bayles, et al. (1989) compared dementia and fluent aphasia with nonfluent

*: Tokyo Metropolitan Institute of Gerontology

** : Tokyo Metropolitan Geriatric Hospital

aphasia using the Arizona Battery for Communication Disorders of Dementia. Data on dementia patients of different etiology are also scarce. Most studies deal with senile dementia of Alzheimer's type, while only a few have attempted comparisons among dementia patients with different etiologies (Bayles & Tomoeda, 1983; Whitworth, 1989). A comparison of performance among patients with aphasia and those with vascular dementia on a comprehensive neuropsychological test battery has not been attempted thus far.

In order to investigate the nature of impairment in neuropsychological functions in Japanese patients with dementia, we organized an examination consisting of 20 neuropsychological tests covering four broad cognitive areas (Sasanuma, et al., 1986). Performance levels of a mild to moderate dementia group (N=102) were significantly inferior to those of normal elderly group (N=80) on all 20 tests, thus confirming the face validity of this neuropsychological test in measuring the neuropsychological functions of demented patients (Sasanuma, et al., 1987).

The purpose of the present study is to conduct a comparative study on the performances of aphasic patients and demented patients for a series of neuropsychological tests, and to analyze the results with special reference to differences between aphasia types and etiologies of dementia.

Method

Subjects

Two groups of patients were studied, i.e. stroke patients with aphasia (N=102) and demented patients (N=93). The latter group was further divided according to the etiology of dementia: 54 patients with dementia of Alzheimer's type (abbreviated to DAT, hereafter), and 39 patients with vascular dementia.

The aphasia patients were selected from the clinical population of the Speech Pathology Service, the Tokyo Metropolitan Geriatric Hospital. They fulfilled all the following selection criteria: (1) right handed, (2) brain lesion confined to the left cerebral hemisphere, (3) no history of cognitive decline, (4) no concomitant communication disorder in addition to aphasia. The mean period of time elapsed between the onset of aphasia and the test administration was 10.7 months (SD; 19.0 months). The aphasic patients were further divided into subgroups based on the results of the Roken Test of Differential Diagnosis of Aphasia (RTDDA). Twenty patients were classified as anomic aphasia, 26 as Broca's aphasia, 20 as Wernicke's aphasia, 9 as global aphasia, 5 as conduction aphasia, 5 as aphasia having alexia and/or agraphia, and 17 as unclassified aphasia.

The dementia patients were diagnosed at the Department of Psychiatry, the Tokyo Metropolitan Geriatric Hospital or at the Department of Neurology, the Matsudo City Hospital. They all met the diagnostic criteria for mild to moderate DAT and vascular dementia. Furthermore they fulfilled all the following selection criteria: (1) free from severe impairment of vision or hearing, (2) right handed, and (3) more than 6 years of education.

Table 1 shows the characteristics of the subject groups. There were more men than women in the aphasia group and the vascular dementia group, while this relationship was reversed in the DAT group. One-way analyses of variance identified differences among groups compared for age ($F=38.9$, $df=2$, $P<0.01$) and education ($F=19.8$, $df=2$, $p<0.01$). Scheffe post-hoc analyses indicated that the aphasic patients were significantly younger and better educated than the two dementia groups.

The neuropsychological tests

Table 2 shows the contents of the neuropsychological test. The test consisted of 20 subtests assessing four major areas of higher cortical functions: orientation (test 1), memory (test 2-5), linguistic abilities (test 6-14), and visuospatial abilities (test 15-20) (Sasanuma, et al., 1987).

The tests assessing orientation (1 test) and memory (4 tests) are similar to the tasks commonly used for the assessment of dementia. The nine tests assessing linguistic abilities are similar to the tasks commonly used in the aphasia test battery. They are sensitive for measuring semantic, phonological and syntactic aspects of language. The tests assessing the visuospatial functions consist of two tests for visuospatial perception, i.e. Facial Recognition test (Mori, et al., 1976) and Judgment of Line Orientation (Benton, et al., 1975; Benton, et al., 1983), three tests for construction abilities, i.e. Clock Face Drawing, Clock Setting and Three-Dimensional Block Construction (Benton, 1973; Benton et al., 1983), and a test of Tactile Form Perception by Benton and coworkers (Dee & Benton, 1970; Benton et al., 1983) which was designed to assess supra modal spatial thinking using cross-modal (tactile to visual) matching of geometrical figures.

Procedures

The test was given individually in a quiet room. The time required was from 2 to 3 hours for the majority of the subjects. Thus, the test was administered in two or three sessions over the period of a week or two.

Data Analysis

Multiple t tests were used to compare the group pair (aphasia vs. dementia). One-way analyses of variance (ANOVAS), and post-hoc Scheffé contrasts among groups were

performed in comparing aphasia vs. the two dementia groups, dementia vs. different types of aphasia.

Results

(1) Comparison of Performance in Aphasic Patients and Demented Patients

Table 3 shows the means, standard deviations (SD), and t-test results on each test for the aphasic and demented patients. The means for each subject group was plotted against the performance of 80 normal elderly in their 60s through 80s (Figure 1). The solid line represents the performance level of the aphasic patients, and the dotted line represents that of the demented patients. The solid square mark indicates that the aphasic patients performed significantly better than the demented patients ($p < 0.05$) on that test, whereas the open triangular mark indicates that the aphasic patients performed significantly worse ($p < 0.05$) on that test. Examination of Figure 1 reveals distinct differences in test profiles between the two patient groups. The aphasic patients were significantly superior to the demented patients for 8 tests: Orientation, Story Recall (Delayed), and all the tests of visuospatial functions. On the other hand, the aphasic patients were significantly inferior to the demented patients for 8 tests: Digit Retention Span, Digit Pointing Span, Sentence Repetition, Follow Commands, Naming, Word Fluency (Phonological), Oral Reading and Reading Comprehension. Levels of significance for these 16 tests were 0.01 except for Story Recall (Delayed) ($p < 0.05$). The means for the two subject groups did not differ for four tests: Story Recall (Immediate), Word Fluency (Semantic), Picture Description and Writing Sentences.

Table 4 shows the means and standard deviations for each test in the aphasia patients, DAT patients, and vascular dementia patients. Although overall performance levels were similar between the two groups of dementia, the patients with vascular dementia had significantly higher means on Orientation and Story Recall (Delayed) as compared to the patients with DAT. Levels of significance for both tests were 0.01 and 0.05, respectively.

Table 5 summarizes the results of the statistical analysis of the data shown in Table 3 and 4. When the aphasic patients were compared separately with the DAT and vascular dementia patients a similar performance pattern was observed on 17 out of the 20 tests. Out of the remaining 3 tests showing a different pattern, the performance level on two tests, Orientation and Story Recall (Delayed), was found to be significantly different between the aphasic patients and DAT patients ($p < 0.01$), but not so between the patients with aphasia and vascular dementia. On the contrary, the performance level on Follow Commands was significantly different between the patients with aphasia and vascular dementia. ($p < 0.01$).

(2) Comparison of Aphasic Patients and Demented Patients with respect to Type of Aphasia

1) Comparison of aphasic patients with three major types of aphasia and patients with dementia

In the present study, the performances of three major types of aphasia, viz. anomic aphasia, Broca's aphasia and Wernicke's aphasia, were compared separately with the performance of demented patients.

Table 6 shows the means and standard deviations for each test for each group of patients. Table 7 summarizes the results of a statistical analysis of the data shown in Table 6. Although the performance level on each test varied among the different types of aphasia, these differences will not be discussed in this report.

First, it is evident from Table 7 that there is a similarity among the results of the three comparisons, and the three groups of aphasic patients performed significantly better than the group of dementia for the four tests assessing visuospatial functions: Facial Recognition, Three-Dimensional Block Construction, Line Orientation and Tactile Form Perception ($p < 0.01$). As for the remaining two tests assessing visuospatial constructive functions, namely, Clock Face and Clock Setting, the patients with anomic as well as Broca's aphasia showed higher scores than the patients with dementia ($p < 0.01$), while there was no difference between the patients with Wernicke's aphasia and dementia.

Second, the number of tests for which the mean performance scores for the aphasic subgroups were found to be significantly different from dementia ($p < 0.01$) varied depending on the type of aphasia; namely 10 tests for anomic aphasia, 14 for Broca's aphasia and 16 for Wernicke's aphasia. In other words, the number of tests showing no difference in performance between aphasic subgroups and dementia was 10 for anomic aphasia, 6 for Broca's aphasia and 4 for Wernicke's aphasia, respectively. That is to say, the anomic aphasic patients and the dementia patients shared common characteristics most often among the three types of aphasia.

Third, out of the tests assessing the three major areas aside from visuospatial function, the nature of the tests that showed significant differences between aphasia and dementia differed depending on the type of aphasia. The anomic aphasia patients exhibited the highest mean scores on all the tests for linguistic abilities among the three groups of aphasia. Furthermore, the patients with anomic aphasia were superior to the patients with dementia for four tests: Orientation, Story Recall (Delayed), Word Fluency (Semantic), and Picture Description ($p < 0.01$). The Broca's aphasia patients showed significantly lower ($p < 0.01$) performance for the two tests of memory compared with the dementia patients -- Digit Repetition Span and Digit Pointing Span were significantly lower ($p < 0.01$)-- while showing superior performance for Orientation and Story Recall

(Delayed) ($p < 0.05$). For those tests assessing linguistic functions, the Broca's aphasia patients were significantly poorer than the demented patients on 4 tests: Repetition, Naming, Word Fluency (Phonological), and Oral Reading. These tests require phonological operations in addition to lexical/semantic ability. The Wernicke's aphasia patients showed the lowest mean scores for all of the tests assessing linguistic functions among the three aphasia groups. With the exception of Orientation and Story Recall (Delayed), for which their means did not differ from those of the dementia patients, the Wernicke's aphasia patients showed poorer performance compared with demented patients for all of the 9 tests assessing linguistic functions in addition to the three memory tests.

2) Comparison of the groups of patients with three major aphasia types and the groups of dementia patients with different etiology

Table 8 shows the results of a statistical analysis comparing the test performances in the groups of patients with three major aphasia types and the dementia patients with different etiology, as well as comparisons with the total dementia group. Figures 2, 3, and 4 show the test profiles of the patients with anomic, Broca's, and Wernicke's aphasia, respectively, in comparison with the patients with those of DAT and vascular dementia.

The comparison of the three major aphasia types and the DAT revealed the following results. The number of tests for which the means were significantly different from the patients with DAT, was 11 for anomic aphasia and 12 for both Broca's and Wernicke's aphasia. This result was different from that obtained in comparison with the total dementia group. For anomic aphasia, the means for Story Recall (Immediate) did not differ from those of the patients in the total dementia group, but they were significantly higher when compared to those of the patients with DAT separately ($p < 0.01$). In addition, the level of significance changed from 0.05 to 0.01 for Picture Description when anomic aphasia was compared with DAT alone. For Broca's aphasia, the means for Digit Pointing Span and Word Fluency (Phonological) --which showed significant differences from those of the total dementia group-- remained so when compared with the patients with DAT separately. For Wernicke's aphasia, the means for the Story Recall (Immediate), Word Fluency (phonological) and Word Fluency (Semantic) tests were significantly lower than those of the total dementia groups and remained so when compared with patients with DAT separately. With respect to Writing Sentences for Wernicke's aphasia, the level of significance changed from 0.01 to 0.05 when compared with the patients with DAT separately.

The comparison between the three major aphasia types and the patients with vascular dementia revealed the following results. The number of tests for which the means differed significantly from those of the group of vascular dementia was nine for Anomic and Broca's aphasia, and 16 for Wernicke's aphasia. These results differ both from the results comparing the same three groups with the total dementia group and with

the group of DAT. For anomic aphasia, significant differences between the two comparisons were seen in the following two tests: Story Recall (Delayed) and Orientation. The patients with anomic aphasia performed significantly better compared with the total dementia group and the patients with DAT separately for Story Recall (Delayed). However, the comparison between the three major aphasia types and the patients with vascular dementia failed to reveal any difference. The means for anomic aphasia on the Orientation test were superior to the total dementia group at the significance level of 0.01. However, the significance level decreased to 0.05 when compared with the patients with vascular dementia separately. In Broca's aphasia, the comparison with the total dementia group revealed differences in performance for the following 5 tests: Orientation, Digit Repetition Span, Digit Pointing Span, Story Recall (Delayed) and Word Fluency (Phonological). However, the comparison with vascular dementia failed to reveal any difference. For the Wernicke's aphasics, the separate comparisons with the total dementia group and with the vascular dementia group separately revealed no difference.

Discussion

The present investigation demonstrated that a series of neuropsychological tests assessing orientation, memory, linguistic functions and visuospatial constructive functions was able to reveal the following findings: (1) significant differences were found between aphasia and dementia depending on the areas tapped, (2) the tests that revealed differential performance between the two diagnostic groups varied according to the type of aphasia, and (3) the performance of the two dementia groups differed when compared with aphasia group.

Differences between aphasia and dementia

The results of our present study clearly support the previously reported general distinction between aphasia and dementia (Rockford, 1971; Watson & Records, 1978; Deal, et al., 1981; Appell, et al., 1982; Wertz, 1982; Nicholas, et al., 1985; Boone & Bayles, 1986; Bayles & Kaszniak, 1987; Huff, et al., 1988; Emery, 1988; Bayles, et al., 1989; Stevens, 1989; Watamori, et al., 1989). The report by Bayles, et al. (1989) has been the only study thus far to employ a series of neuropsychological tests. They compared 5 groups of subjects: Controls, mild Alzheimer's disease, moderate Alzheimer's disease, nonfluent aphasia and fluent aphasia separately. However, they did not report any group differences between aphasia and dementia.

The present findings suggest three distinct neuropsychological characteristics in aphasic patients when compared with demented patients.

The first finding concerns the aspect of memory. While all the aphasic patients

demonstrated poorer performance on the test of immediate memory compared to the demented patients, their ability for recall of information after a certain period of delay was relatively well preserved. Although the means for Story Recall (Immediate) failed to reveal any difference between the two groups, a striking decline in performance was noted for Story Recall (Delayed)*(FOOT NOTE) in the demented patients. These data suggest that the nature of the memory disturbance in aphasic patients is definitely different from that in demented patients.

The second finding concerns the aspect of linguistic functions. Although the aphasic patients showed a general reduction in linguistic functions, their difficulties were not confined to phonological aspects of language, tapped by such tests as Sentence Repetition, Word Fluency (Phonological) and Oral Reading: The poorer performance among a part of the aphasic subjects for such tests as Follow Commands, Naming and Reading Comprehension suggests that the semantic aspect of language is also compromised in this group of patients. The dementia patients' performance for Word Fluency (Semantic) and Picture Description failed to reveal any difference from the aphasic group thus indicating that the problem might lie at the level of semantic processing in the dementia patients as well as in the aphasia patients. On the other hand, The demented patients showed highly preserved a ability for Sentence Repetition and Oral Reading which was close to normal level. This finding is also in agreement with previous reports regarding the language disorders of demented patients (Watamori, et al., 1983; Watamori & Etoh, 1983; Bayles & Kaszniak, 1987; Sasanuma, 1990).

The third finding concerns the aspect of visuospatial functions. These are the most discriminating tests between the aphasic patients and the demented patients. The aphasic patients' performances were similar to those of the normal elderly.

It can be concluded that a substantial part of the difficulty of the aphasic patients lies in linguistic functions as revealed by the series of neuropsychological tests employed in the present study. This apparent deterioration in orientation and/or memory might be interpreted as reflections the factors of language mediation required for executing the tests.

Comparisons of three major aphasia types and dementia

The data in our study revealed different patterns of deterioration in linguistic as well as nonlinguistic functions depending on the type of aphasia.

First of all, the overall performance level of the three types of aphasia on the tests assessing visuospatial functions were similar to the normal elderly except for Wernicke's aphasia. The performance of Wernicke's aphasia patients for Clock (Face, Setting) did not differ from the total dementia group, or DAT or vascular group, compared separately. For Tactile Form Perception test, the Wernicke's aphasic patients performed better than

the vascular dementia or the total dementia group but failed to show differences from the DAT group.

Secondly, in the examination of the three areas excluding the area of visuospatial functions, the performances of the patients with anomic aphasia were consistently high, while the performances of the patients with Wernicke's aphasia were consistently low, as compared with the patients with dementia. The performances of the patients with Broca's aphasia lay in between. It may be concluded that the differences in aphasia type reflect the degree of language disturbance since the tests involve the stimulus-response system mediated by language. It has been known that the ranking of anomic aphasia, Broca's aphasia and Wernicke's aphasia also represents the order of the severity of language disturbance in the early recovery period in aphasia (Fukasako & Monoi, 1984).

Speaking of the differential patterns of disturbance in the four areas of functions seen in each of the three major groups of aphasia, the patients with anomic aphasia showed superior performance for Orientation, Story Recall (Delayed), Word Fluency (Semantic) and Picture Description compared with that of the patients with dementia. All the remaining tests failed to show differences between the two groups. The patients with Broca's aphasia were distinguished from the other two types of aphasia by a remarkably low performance level on the tests concerned with phonological processing and verbal immediate memory. The overall poor performance in the Wernicke's aphasia patients can be explained by their severe language impairment, and their auditory comprehension deficits in particular.

The present study is the first reporting a comparison between patients with aphasia and vascular dementia. Few reports have tried to differentiate patients with DAT and vascular dementia with respect to their linguistic functions (Hier, et al., 1985; Sasanuma, 1988; Kontiola, et al., 1990). Our attempts to compare etiologically different dementia groups with aphasia or different types of aphasia made it possible to distinguish the characteristics of the neuropsychological deficits in etiologically different dementia groups. The neuropsychological differences between aphasia and vascular dementia should be investigated further since (1) approximately 90 per cent of aphasic patients is caused by CVA, (2) the incidence of aphasic patients with the complication of vascular dementia increases with age (Fukasako, 1988; Monoi, 1991) (in those reports, the term "general intellectual deficit" was used instead of vascular dementia, but the former is believed to overlap greatly with the latter).

It can be concluded that the findings presented here have implications for such issues as identifying linguistic and nonlinguistic deficit patterns between aphasia and dementia, as well as of distinguishing aphasia from dementia or aphasia complicated with dementia in a clinical setting.

Summary

The performance of 102 stroke patients with aphasia and 93 patients with mild to moderate dementia (54 with dementia of Alzheimer's type, 39 with vascular dementia) were investigated using a series of neuropsychological tests covering four broad areas: orientation, memory, linguistic function and visuospatial functions, to explore differences in performance between the two diagnostic groups. Major findings include the following.

- (1) A series of neuropsychological tests revealed remarkably different patterns of deficit between the patients with aphasia and the patients with dementia.
- (2) The aphasic groups showed significantly higher means for Orientation, Story Recall (Delayed) and all tests of visuospatial function, compared to the patients with dementia. However, their performance on the tests of linguistic function were significantly lower than the demented group.
- (3) Performance for each test varied depending on the type of aphasia.
- (4) Finally, differences in neuropsychological deficits were found between dementia of Alzheimer's type and vascular dementia when the two groups were compared separately with the aphasia groups.

Acknowledgements

This study started as the research project "Neuropsychological Study of Dementia" (leader: Sumiko Sasanuma, Ph. D., then Director, Department of Rehabilitation Research, and Head, Communication Research) under a larger multidisciplinary research project on dementia at the Tokyo Metropolitan Institute of Gerontology (leader: Akihide Karasawa, M.D., then Director, Department of Psychiatry). It began in 1983 and ended in 1988. The same research theme of the differentiation of aphasia and dementia has been continued after the end of this project. The authors wish to express their gratitude to the Department of Psychiatry of the Tokyo Metropolitan Geriatric Hospital (Head: Matzoh Kido, M.D.) and the Department of Neurology of the Matsudo City Hospital (Head: Kunitaka Kitano, M.D.) for their assistance in the recruitment and testing of the subjects. We also would like to thank Prof. Hajime Hirose (Director, Research Institute of Logopedics and Phoniatrics, Faculty of Medicine, University of Tokyo) for his helpful advice on the preparation of this manuscript. In addition, we would like to acknowledge the assistance in data collection during the research project of the following people then at the Tokyo Metropolitan Institute of Gerontology: Motonobu Itoh, Ph.D. (present affiliation: City of Yokohama Rehabilitation Center), Kazuyoshi Fukuzawa, Ph.D. (present affiliation: Waseda University) and Naoko Sakuma, B.A.

A part of this paper was presented at the 28th Convention of the Japanese Society of Rehabilitation Medicine, Tokyo, 1991.

References

- 1) J. Appell, A. Kertesz and M. Fishman: A study of language functioning Alzheimer's patients. *Brain and Language*, 17, 73-91, 1982.
- 2) K.A. Bayles and A.W. Kaszniak: Communication and cognition in normal aging and dementia (pp.185-197). College-Hill Press, MA, 1987.
- 3) K.A. Bayles, D.R. Boone, C.K. Tomoeda, T.J. Slauson and A.E. Kaszniak: Differentiating Alzheimer's patients from the normal elderly and stroke patients with aphasia. *J. Speech Hearing Dis.*, 54, 74-87, 1989.
- 4) K.A. Bayles & C.K. Tomoeda: Delayed recall deficits in aphasia stroke patients: Evidence of Alzheimer's dementia? *J. Speech Hearing Dis.*, 55, 310-314, 1990.
- 5) A.L. Benton: Visuo-constructive disability in patients with cerebral disease; Its relationship to site of lesion an aphasic disorder. *Documenta Ophthalmologica*, 34, 67-76, 1973.
- 6) A.L. Benton, H.J. Hannay and N.R. Varney: Visual perception of line direction in patients with unilateral brain disease. *Neurology*, 25, 907-910, 1975.
- 7) A.L. Benton, K. Hamsher, N.R. Varney and O. Spreen: Contributions to neuropsychological assessment. A Clinical Manual. Oxford University Press, New York, 1983.
- 8) D.R. Boone and K.A. Bayles: Communication disorders in an elderly population. Final report for Andrus Grant, 1986.
- 9) J.L. Deal, R.T. Wertz and C. Spring: Differentiating and the language of generalized intellectual impairment. In R.H. Brookshire (Eds.), *Proceedings of the Clinical Aphasiology Conference 1981* (pp. 166-173). Minneapolis, MN:BRK Publishers.
- 10) H.L. Dee and A.L. Benton: A cross modal investigation of spatial performances in patients with unilateral cerebral disease. *Cortex*, 6, 261-272, 1970.
- 11) O.B. Emery: Language and memory processing in senile dementia Alzheimer's type. In L.L. Light and D.M. Burke (Eds.): *Language, Memory and Aging* (pp. 221-243). Cambridge University Press, 1988.
- 12) D. Fromm & A.L. Holland: Functional communication in Alzheimer's disease. *J. Speech Hearing Dis.*, 54, 535-540, 1989.
- 13) Y. Fukusako and H. Monoi: The influence of age and sex on the type and severity of aphasia. *Jpn. J. Logop. Phoniater.*, 25, 1-12, 1984.
- 14) Y. Fukusako: Aphasia in the elderly. *Jpn. J. Gerontopsychiatry*, 5, 517-530, 1988.
- 15) H. Halpern, F.L. Darley and L.R. Brown: Differential language and neurologic characteristics in cerebral involvement. *J. Speech Hearing Dis.*, 38, 162-173, 1972.
- 16) D.B. Hier, K. Hagenlocker and A.G. Shindler: Language disintegration in dementia; Effects of etiology and severity. *Brain and Language*, 25, 117-133, 1985.
- 17) F.J. Huff, L. Mack, J. Mahlmann and S. Greenberg: A comparison of lexical-semantic impairments in left hemisphere stroke and Alzheimer's disease. *Brain and Language*, 34, 262-278, 1988.
- 18) P. Kontiola, R. Laaksonen, R. Sulkava and T. Erkinjuntti: Pattern of language impairment is different in Alzheimer's disease and multi-infarct dementia. *Brain and Language*, 38, 364-383, 1988.

- 19) H. Monoi: Communication disorders in the elderly: From the clinical viewpoint. *Jpn. J. Logop. Phoniatr.*, 32, 227-234, 1991.
- 20) K. Mori, S. Sasanuma, T.S. Watamori and T. Fujita: Effects of aging on cognitive abilities: Performance of normal subjects in their 20's through 80's on Benton's Three Dimensional Block Construction and Facial Recognition Test. *Jpn. J. Geriatrics*, 13, 356. 1976.
- 21) M. Nicholas, L.K. Obler, M.L. Albert and N. Helm-Estabrooks: Empty speech in Alzheimer's disease and fluent aphasia. *J. Speech Hearing Res.*, 28, 405-410, 1985.
- 22) G. Rockford: A study of naming errors in dysphasic and in demented patients. *Neuropsychologia*, 9, 437-443, 1971.
- 23) S. Sasanuma, M. Itoh, T.S. Watamori, K. Fukuzawa, N. Sakuma, Y. Fukusako and H. Monoi: Linguistic and nonlinguistic abilities of the Japanese elderly and patients with dementia. In H.K. Ulatowska (Ed.), *The Aging Brain* (pp. 175-200). College-Hill Press, San Diego, California, 1985.
- 24) S. Sasanuma, M. Itoh, T.S. Watamori, K. Fukuzawa, N. Sakuma, Y. Fukusako and H. Monoi: Neuropsychological investigation of dementia. Tokyo Metropolitan Institute of Gerontology Research Project Report on Senile Dementia (1982-1985), pp. 68-87, 1986.
- 25) S. Sasanuma, M. Itoh, T.S. Watamori, K. Fukuzawa, N. Sakuma, Y. Fukusako and H. Monoi: Neuropsychological investigation of dementia; Heterogeneity of cognitive impairment. *Jpn. J. Neuropsychology*, 3, 216-215, 1987.
- 26) S. Sasanuma: Patterns of cognitive abilities in the elderly and demented patients on the Higher Cortical Functions Test Battery. *Jpn. J. Gerontopsychiatry*, 5, 504-516, 1988.
- 27) S. Sasanuma: Neuropsychological symptoms of dementia: A longitudinal study. *Higher Brain Function Research*, 10, 111-117, 1990.
- 28) S.J. Stevens: Differential naming difficulties in elderly dysphasic subjects and subjects with senile dementia of the Alzheimer type. *British J. Dis. Communication*, 24, 77-92, 1989.
- 29) T.S. Watamori, S. Murakami, M. Itoh and S. Sasanuma: Language disorders in senile dementia; A review of recent findings. *Clinical Psychiatry*, 25, 914-922, 1983.
- 30) T.S. Watamori and F. Etoh: A longitudinal study of linguistic and nonlinguistic functions in a patient with Alzheimer's disease. *Jpn. J. Clinical Psychiatry*, 12, 1155-1168, 1983.
- 31) T.S. Watamori, A. Takeuchi, Y. Fukusako, T. Miyamori, T. Suzuki, K. Endo, M. Itoh and S. Sasanuma: Functional communication in dementia patients. *Jpn. J. Rehab. Med.*, 26, 23-33, 1989.
- 32) J.M. Watson and L.E. Records: The effectiveness of the Porch Index Communicative Ability as a diagnostic tool in assessing specific behaviors of senile dementia. In R.H. Brookshire (Ed.): *Proceedings of the Clinical Aphasiology Conference 1978* (pp. 93-105), Minneapolis, MN: BRK Publishers.
- 33) R.T. Wertz: Language deficit in aphasia and dementia; The same as, different from, or both. In R.H. Brookshire: *Proceedings of the Clinical Aphasiology Conference 1982* (pp.350-359). Minneapolis, MN: BRK Publishers.

34) R.H. Whitworth & C.M. Larsen: Differential diagnosis and staging of Alzheimer's disease with an aphasia battery. *Neuropsychiatry, Neuropsychology and Behavioral Neurology*, 1, 255-265, 1989.

P.7 FOOT NOTE:

*: In tests of Story recall (immediate and delayed) a simple short story is read aloud by the examiner. The subject is asked to retell the story immediately after the reading is over (immediate), and once again after a period of 30 minutes, during which the subject is occupied with other tests.

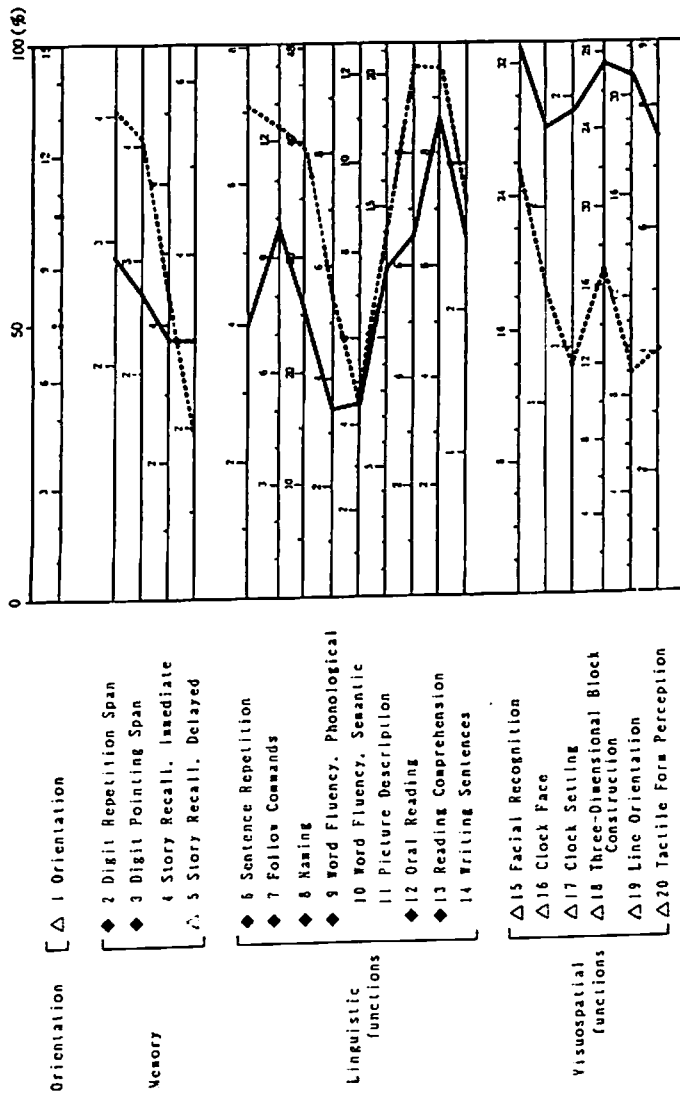


Figure 1 The Test Profile of Aphasic Patients and Demented Patients

The mean percentage correct responses for each test for patients of each group plotted against the baseline of 100 per cent. In calculating this baseline the mean of correct responses on each test for 80 normal elderly in their 60s through 80s was converted to the 100 per cent performance level.

- ◆ indicates aphasic group found to be significantly higher at the $p < 0.05$ or $p < 0.01$.
- △ indicates aphasic group found to be significantly lower at the $p < 0.05$ or the $p < 0.01$.
- aphasic patients
- demented patients

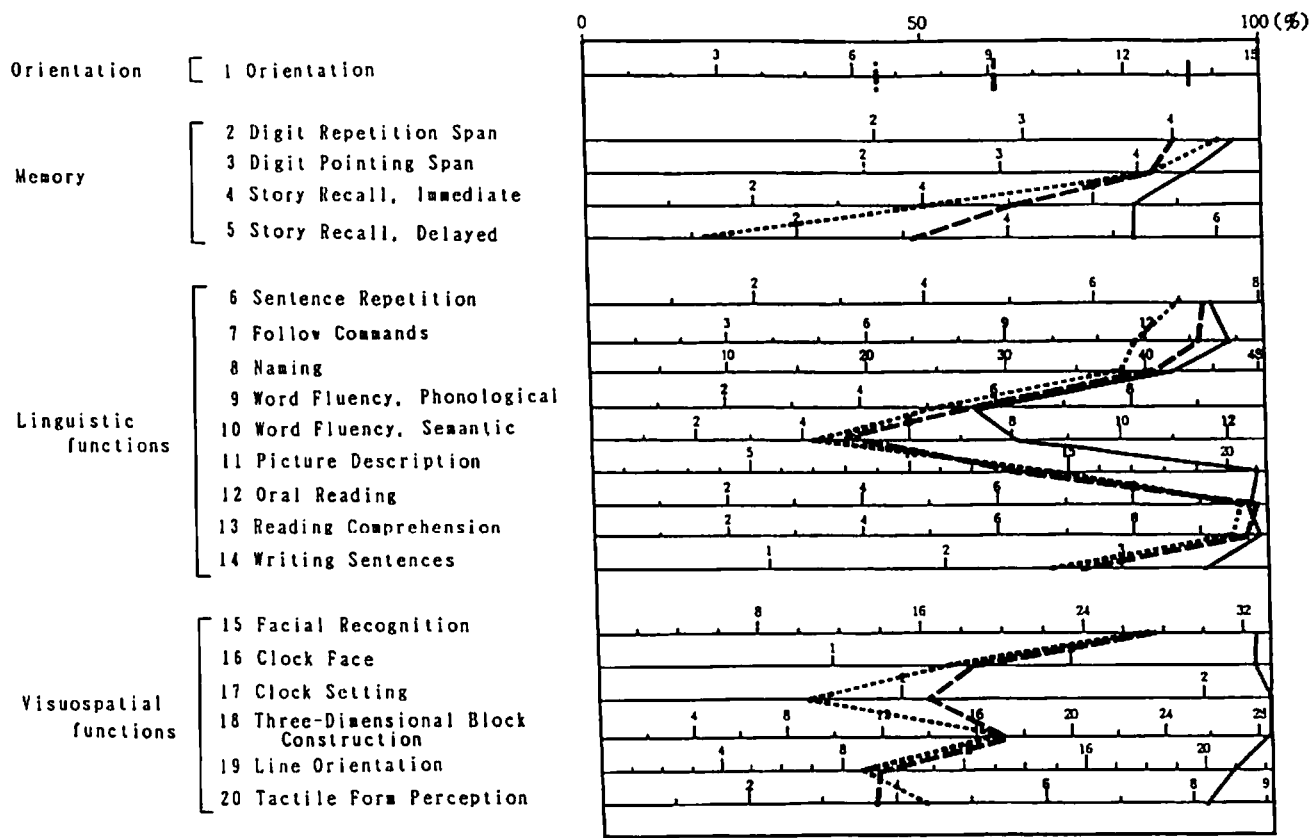


Figure 2 The Test Profile of Patients with Anomic Aphasia in Comparison with Two Types of Dementia

_____ anomic aphasia
 dementia of Alzheimer's type
 - - - - - vascular dementia

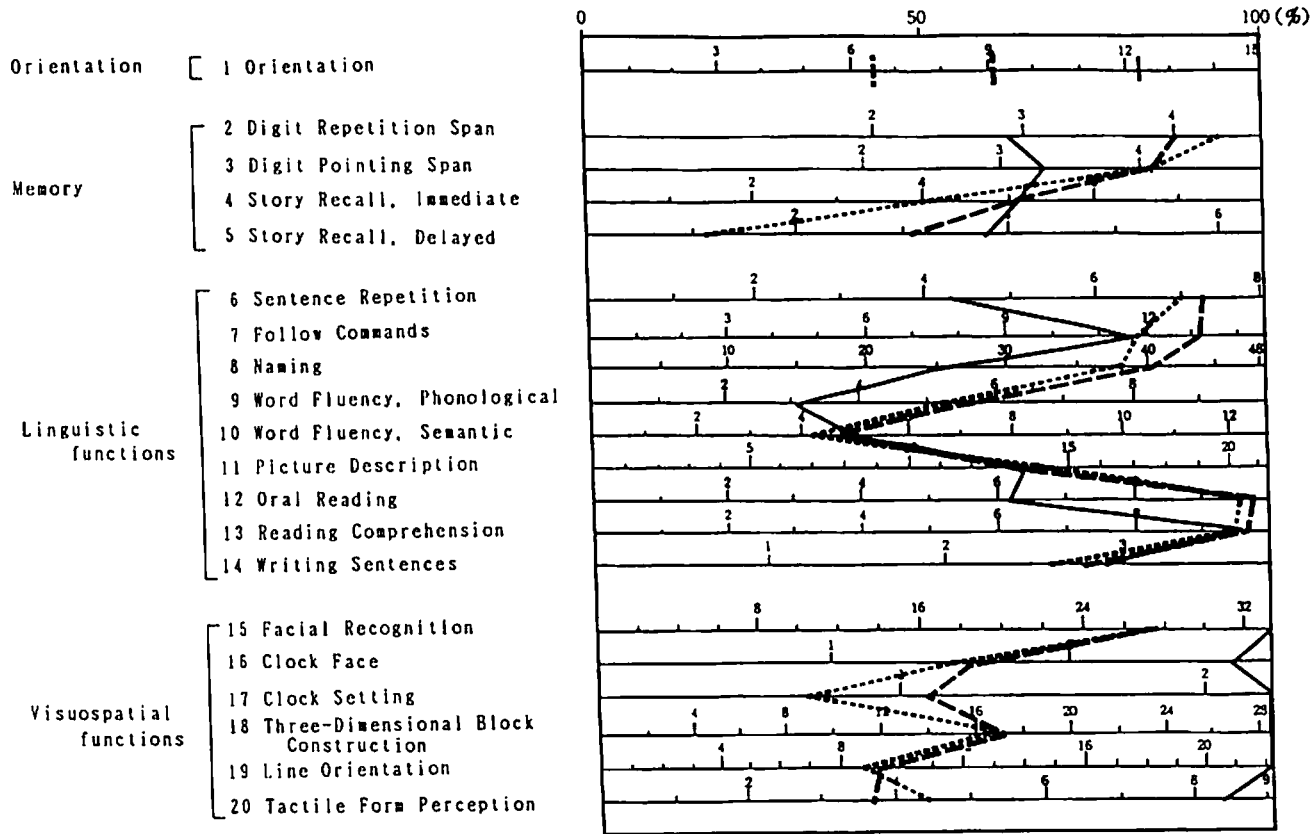


Figure 3 The Test Profile of Patients with Broca's Aphasia in Comparison with Two Types of Dementia

— Broca's aphasia
 dementia of Alzheimer's type
 - - - vascular dementia

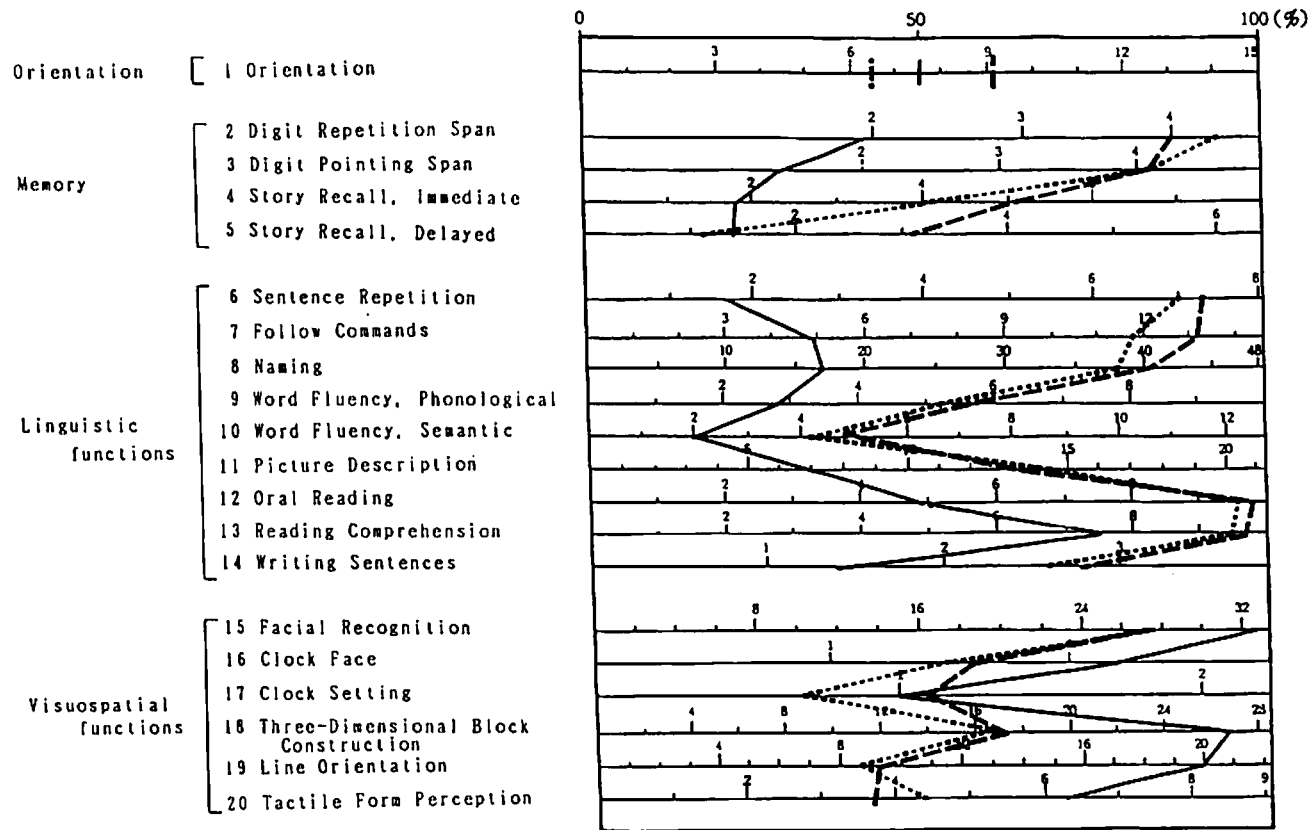


Figure 4 The Test Profile of Patients with Wernicke's Aphasia in Comparison with Two Types of Dementia

——— Wernicke's aphasia
 dementia of Alzheimer's type
 - - - - vascular dementia

Table 1 Composition of Subject Groups

Diagnosis	Number of Cases	Sex	Age(years) Mean(SD)	Education(years) Mean(SD)
Aphasia	102	(Male 71) (Female 31)	59.0(12.3)*	11.9(3.3)**
DAT	54	(Male 12) (Female 42)	74.4(9.1)	9.1(3.3)
VAD	39	(Male 24) (Female 15)	70.2(9.1)	8.7(3.1)

 DAT: dementia of Alzheimer's type

VAD: vascular dementia

* indicates mean age in aphasia group found to be significantly younger at the 0.01 level than the other two groups.

** indicates mean years of education in aphasia group found to be significantly higher at the 0.01 level than the other two groups.

Table 2 Neuropsychological Test

Test	Areas Assessed
1. Orientation	Orientation
2. Digit Span, Oral Repetition	Memory
3. Digit Span, Pointing	
4. Story Recall, Immediate	
5. Story Recall, Delayed	
6. Repetition of Sentences	
7. Follow Commands	Linguistic functions
8. Naming	
9. Word Fluency, Phonological Index	
10. Word Fluency, Semantic Index	
11. Picture Description	
12. Reading Aloud Words in Kanji and Kana	
13. Reading Comprehension of Words in Kanji and Kana	
14. Writing a Sentence to Dictation	
15. Facial Recognition	Visuospatial functions
16. Clock: Drawing Face	
17. Clock: Setting	
18. Three-Dimensional Block Construction	
19. Judgment of Line Orientation	
20. Tactile Form Perception	

Table 3 t-Test Results --Comparison of Aphasic Patients and Demented Patients --

Test	Aphasia (N=102) Mean(SD)	Dementia (N=93) Mean(SD)	p
1 Orientation	10.4(5.0)	7.6(4.8)	*
2 Digit Repetition Span	2.8(1.9)	4.1(1.0)	*
3 Digit Pointing Span	2.7(1.9)	4.1(0.9)	*
4 Story Recall, Immediate	3.8(3.4)	4.5(2.6)	
5 Story Recall, Delayed	3.0(3.1)	1.9(2.4)	*
6 Sentence Repetition	4.0(3.1)	7.1(1.4)	*
7 Follow Commands	9.7(5.0)	12.4(3.0)	*
8 Naming	26.1(17.9)	39.2(9.5)	*
9 Word Fluency, Phonological	3.4(3.2)	5.4(3.2)	*
10 Word Fluency, Semantic	4.5(4.0)	4.5(3.1)	
11 Picture Description	12.7(9.5)	14.0(6.4)	
12 Oral Reading	6.5(4.1)	9.7(0.8)	*
13 Reading Comprehension	8.6(2.5)	9.6(1.4)	*
14 Writing Sentences	2.5(1.4)	2.7(1.5)	
15 Facial Recognition	33.0(4.8)	25.7(7.4)	*
16 Clock Face	2.4(0.8)	1.6(1.1)	*
17 Clock Setting	1.9(1.0)	0.9(1.0)	*
18 Three-Dimensional Block Construction	27.4(4.0)	16.9(10.1)	*
19 Line Orientation	20.9(6.1)	9.0(7.6)	*
20 Tactile Form Perception	7.5(2.6)	4.1(2.9)	*

*: p<0.01

Table 4 Comparison of Aphasia and Two Types of Dementia
(Group Performance on Tests)

Test	Aphasia (N=102) Mean (SD)	DAT (N=54) Mean (SD)	VAD (N=39) Mean (SD)
1 Orientation	10.4(5.0)	6.5(4.7)	9.1(4.6)
2 Digit Repetition Span	2.8(1.9)	4.4(1.1)	4.0(1.0)
3 Digit Pointing Span	2.7(1.9)	4.1(1.0)	4.1(1.9)
4 Story Recall, Immediate	3.8(3.4)	4.0(2.4)	5.1(2.8)
5 Story Recall, Delayed	3.0(3.1)	1.1(1.8)	3.1(2.6)
6 Sentence Repetition	4.0(3.1)	7.0(1.6)	7.3(1.1)
7 Follow Commands	9.7(5.0)	11.8(3.6)	13.2(1.8)
8 Naming	26.1(17.9)	38.1(9.9)	40.6(8.9)
9 Word Fluency, Phonological	3.4(3.2)	5.2(3.0)	5.6(3.4)
10 Word Fluency, Semantic	4.5(4.0)	4.2(2.9)	4.8(3.3)
11 Picture Description	12.7(9.5)	14.4(6.3)	13.5(6.5)
12 Oral Reading	6.5(4.1)	9.6(1.0)	9.8(0.5)
13 Reading Comprehension	8.6(2.5)	9.5(1.7)	9.7(0.8)
14 Writing Sentences	2.5(1.4)	2.6(1.6)	2.8(1.3)
15 Facial Recognition	33.0(4.8)	25.6(8.1)	25.8(6.6)
16 Clock Face	2.4(0.8)	1.5(1.0)	1.6(1.1)
17 Clock Setting	1.9(1.0)	0.7(0.9)	1.1(1.0)
18 Three-Dimensional Block Construction	27.4(4.0)	16.7(10.2)	17.2(10.2)
19 Line Orientation	20.9(6.1)	8.7(7.8)	9.3(7.4)
20 Tactile Form Perception	7.5(2.6)	4.4(2.9)	3.7(2.8)

DAT: dementia of Alzheimer's type

VAD: vascular dementia

Table 5 Comparison of Aphasia and Three Types of Dementia
(Results of Statistical Analysis)

Test	Aphasia (N=102) vs. Dementia (N=93)	Aphasia (N=102) vs. DAT (N=54)	Aphasia (N=102) vs. VAD (N=39)
1 Orientation	☆☆	☆☆	NS
2 Digit Repetition Span	★★	★★	★★
3 Digit Pointing Span	★★	★★	★★
4 Story Recall, Immediate	NS	NS	NS
5 Story Recall, Delayed	☆	☆☆	NS
6 Sentence Repetition	★★	★★	★★
7 Follow Commands	★★	NS	★★
8 Naming	★★	★★	★★
9 Word Fluency, Phonological	★★	★★	★★
10 Word Fluency, Semantic	NS	NS	NS
11 Picture Description	NS	NS	NS
12 Oral Reading	★★	★★	★★
13 Reading Comprehension	★	★	★
14 Writing Sentence	NS	NS	NS
15 Facial Recognition	☆☆	☆☆	☆☆
16 Clock Face	☆☆	☆☆	☆☆
17 Clock Setting	☆☆	☆☆	☆☆
18 Three-Dimensional Block Construction	☆☆	☆☆	☆☆
19 Line Orientation	☆☆	☆☆	☆☆
20 Tactile Form Perception	☆☆	☆☆	☆☆

Dementia: DAT + VAD

DAT: dementia of Alzheimer's type

VAD: vascular dementia

☆ indicates aphasic group found to be significantly higher at the 0.05 level.

☆☆ indicates aphasic group found to be significantly higher at the 0.01 level.

★ indicates aphasic group found to be significantly lower at the 0.05 level.

★★ indicates aphasic group found to be significantly lower at the 0.01 level.

Table 6 Comparison of Three Types of Aphasia and the Dementia Group
(Group Performance on Tests)

Test	Anomic (N=20) Mean(SD)	Broca (N=26) Mean(SD)	Wernicke (N=20) Mean(SD)	Dementia (N=93) Mean(SD)
1 Orientation	13.5(2.4)	12.3(3.2)	7.4(5.3)	7.6(4.8)
2 Digit Repetition Span	4.4(1.2)	2.9(2.0)	1.9(1.7)	4.1(1.0)
3 Digit Pointing Span	4.4(1.0)	3.3(1.9)	1.4(1.5)	4.1(0.9)
4 Story Recall, Immediate	6.5(3.1)	5.1(3.7)	1.8(2.5)	4.5(2.6)
5 Story Recall, Delayed	5.2(3.4)	3.8(3.0)	1.4(2.2)	1.9(2.4)
6 Sentence Repetition	7.4(1.6)	4.3(3.1)	1.7(1.5)	7.1(1.4)
7 Follow Commands	13.9(1.3)	11.7(3.9)	4.8(4.1)	12.4(3.0)
8 Naming	42.1(7.8)	25.8(18.7)	17.0(16.1)	39.2(9.5)
9 Word Fluency, Phonological	5.7(2.7)	3.1(2.8)	2.8(3.4)	5.4(3.2)
10 Word Fluency, Semantic	8.1(2.8)	4.9(3.9)	2.0(2.6)	4.5(3.1)
11 Picture Description	21.0(3.6)	13.6(9.6)	7.0(7.3)	14.0(6.4)
12 Oral Reading	9.7(0.9)	6.2(4.1)	4.9(4.3)	9.7(0.8)
13 Reading Comprehension	9.9(0.3)	9.6(0.8)	7.5(2.9)	9.6(1.4)
14 Writing Sentences	3.5(0.6)	2.9(1.1)	1.4(1.5)	2.7(1.5)
15 Facial Recognition	32.6(4.9)	34.5(3.5)	32.3(5.6)	25.7(7.4)
16 Clock Face	2.8(0.4)	2.7(0.5)	2.2(0.9)	1.6(1.1)
17 Clock Setting	2.5(0.7)	2.3(0.8)	1.0(0.9)	0.9(1.0)
18 Three-Dimensional Block Construction	28.5(1.1)	28.5(1.6)	26.8(4.8)	16.9(10.1)
19 Line Orientation	21.0(4.4)	22.5(4.5)	20.0(8.7)	9.0(7.6)
20 Tactile Form Perception	8.2(1.8)	8.4(2.2)	6.3(2.7)	4.1(2.9)

Dementia Group: patients with dementia of Alzheimer's type and
vascular dementia

Table 7 Comparison of Three Major Aphasia Types and
the Dementia Group
(Results of Statistical Analysis)

Test	Anomic (N=20)	Broca (N=26)	Wernicke (N=20)
	vs. Dem (N=93)	vs. Dem (N=93)	vs. Dem (N=93)
1 Orientation	☆	☆	NS
2 Digit Repetition Span	NS	★	★
3 Digit Pointing Span	NS	★	★
4 Story Recall, Immediate	NS	NS	★
5 Story Recall, Delayed	☆	☆	NS
6 Sentence Repetition	NS	★	★
7 Follow Commands	NS	NS	★
8 Naming	NS	★	★
9 Word Fluency, Phonological	NS	★	★
10 Word Fluency, Semantic	☆	NS	★
11 Picture Description	☆	NS	★
12 Oral Reading	NS	★	★
13 Reading Comprehension	NS	NS	★
14 Writing Sentences	NS	NS	★
15 Facial Recognition	☆	☆	☆
16 Clock Face	☆	☆	NS
17 Clock Setting	☆	☆	NS
18 Three-Dimensional Block Construction	☆	☆	☆
19 Line Orientation	☆	☆	☆
20 Tactile Form Perception	☆	☆	☆

Dementia Group: patients with dementia of Alzheimer's type
and vascular dementia

☆ indicates aphasic group found to be significantly higher
at the $P < 0.01$ or the $p < 0.05$.

★ indicates aphasic group found to be significantly lower
at the $p < 0.01$ or the $p < 0.05$.

Table 8 Performance of Three Major Aphasia Types Compared with the Dementia Group, DAT only Group and VAD only Group (Results of Statistical Analysis)

Test	Anomic (N=20)			Broca (N=26)			Wernicke (N=20)		
	vs.			vs.			vs.		
	Dem N	DAT (93)	VAD (39)	Dem (93)	DAT (45)	VAD (39)	Dem (93)	DAT (45)	VAD (39)
1 Orientation	☆	☆	☆	☆	☆	NS	NS	NS	NS
2 Digit Repetition Span	NS	NS	NS	★	★	NS	★	★	★
3 Digit Pointing Span	NS	NS	NS	★	NS	NS	★	★	★
4 Story Recall, Immediate	NS	☆	NS	NS	NS	NS	★	NS	★
5 Story Recall, Delayed	☆	☆	NS	☆	☆	NS	NS	NS	NS
6 Sentence Repetition	NS	NS	NS	★	★	★	★	★	★
7 Follow Commands	NS	NS	NS	NS	NS	NS	★	★	★
8 Naming	NS	NS	NS	★	★	★	★	★	★
9 Word Fluency, Phonological	NS	NS	NS	★	NS	NS	★	NS	★
10 Word Fluency, Semantic	☆	☆	☆	NS	NS	NS	★	NS	★
11 Picture Description	☆	☆	☆	NS	NS	NS	★	★	★
12 Oral Reading	NS	NS	NS	★	★	★	★	★	★
13 Reading Comprehension	NS	NS	NS	NS	NS	NS	★	★	★
14 Writing Sentences	NS	NS	NS	NS	NS	NS	★	★	★
15 Facial Recognition	☆	☆	☆	☆	☆	☆	☆	☆	☆
16 Clock Face	☆	☆	☆	☆	☆	☆	NS	NS	NS
17 Clock Setting	☆	☆	☆	☆	☆	☆	NS	NS	NS
18 Three-Dimensional Block Construction	☆	☆	☆	☆	☆	☆	☆	☆	☆
19 Line Orientation	☆	☆	☆	☆	☆	☆	☆	☆	☆
20 Tactile Form Perception	☆	☆	☆	☆	☆	☆	☆	NS	☆

Dementia Group: patients with dementia of Alzheimer's type and vascular dementia

DAT: dementia of Alzheimer's type

VAD: vascular dementia

☆ indicates aphasic group found to be significantly higher at the $P < 0.01$ or the $p < 0.05$.

★ indicates aphasic group found to be significantly lower at the $p < 0.01$ or the $p < 0.05$.