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A New Screening Test for Dementia

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Abstract: The purpose of this study is to develop a new screening test for detecting the demented elderly in the early stage in communities. The test is easy to apply for consultation, guidance and care and is capable of administering differential diagnoses. Based on the 9 dementia rating scales used in Japan, Europe and the U.S., a new test was completed after investigating and modifying the design 5 times. The test consists of 20 items. This test was given to 203 subjects (59 males and 144 females) including normal elderly as well as those suspected of suffering from dementia. The internal consistency, reliability and validity were studied using clinical diagnoses (diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III) and Karasawa's Criteria for Judging Senility), Hasegawa's Dementia Rating Scale and Mental Status Questionnaire (MSQ) as external criteria. The present test was confirmed to have sufficient effectiveness as the screening test for dementia.

Key Words: *dementia, dementia screening test, dementia rating scale, elderly*

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INTRODUCTION

Along with the recent increase in the elderly population in Japan, the number of demented elderly is growing rapidly. According to recent researches[12 18] on the health of the elderly in Tokyo conducted in 1980, 4.6% of those aged 65 or older staying at home were found to have senile dementia and including those hospitalized or admitted into nursing homes, the prevalence rate is said to reach 5.5%.[17] The issue of demented elderly is developing into a serious social problem in Japan.

To cope with such a situation, health care services are being extended to demented elderly by public health centers and municipal public bodies (cities, towns and villages). A direct approach among these services is to uncover the elderly suspected of suffering from senile dementia at an early stage and to offer them appropriate care, consultation and guidance by paramedical staff such as public health nurses. We attempted to de-

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velop a new screening test for the early diagnosis of those suspected of having dementia.

Process of the New Screening Test

To make preparations for a screening test for dementia, the concept of dementia must be defined first. The need for establishing clear-cut diagnostic criteria has caused an extensive use of diagnostic criteria for dementia by DSM-III[1] promoted by the American Psychiatric Association. We developed the new test based on these criteria. In the course of development, we selected 90 items out of nine simplified dementia rating scales so far developed[6 8 9 13]—Osaka University's Dementia Scale for the Aged,[7 11] Test on mental aging,[17] Hasegawa's Dementia Scale for the Aged[5] (hereinafter referred to as "Hasegawa Scale"), Mental Status Questionnaire,[10] Information Memory Concentration Test,[3] Abbreviated Mental Test,[16] Short Portable Mental Status Questionnaire,[15] Geriatric Center Mental Status[4] and Orientation Scale for Geriatric Patients.[2] We examined the 90 items in view of the proportion of right answers given by the subjects, Hasegawa Scale, and the correlation coefficient with MSQ, modified the content of items, and conducted a total of 5 pretests. Finally we have come up with a test containing 16 items (memory 5, orientation 5, knowledge 5, judgment-thinking 3 and mental control 2; total 20 scores).

Reliability and Validity for Standardization of the New Screening Test

1) Subjects

In order to examine the reliability and validity of the screening test for dementia, we conducted a test on normal elderly as well as elderly with mild to severe dementia as our subjects.

The subjects consisted of 203 elderly (male 59 and female 144) sampled at random from 5 nursing homes, inpatients and the aged in communities. They ranged in age from 63 to 98.

2) Method

This screening test was conducted by interviewing each individually. To examine its validity, the Hasegawa Scale and MSQ dementia test were carried out concurrently. A couple of psychiatrists diagnosed independently the dementia and its degree in accordance with the dementia diagnostic criteria by DSM-III and Karasawa's criteria for

Table 1: Rate of Correct Response and Correlation between the Items and Total Scores

Items	Rate Correct Response	Correlation Coefficient (r)
1. Year	0.87	0.53
2. Month/date	0.76	0.42
3. What month?	0.77	0.56
4. What day is it today?	0.54	0.58
5. What day of the week was it yesterday?	0.64	0.55
6. What day is May the fifth?	0.77	0.57
7. When is Coming-of-Age Day?	0.43	0.52
8. With what color of a signal do you cross the road?	0.70	0.49
9. What do you call an elder sister of your mother in general?	0.70	0.53
10. What do you call a daughter of your younger sister in general?	0.67	0.60
11. From which direction does the sun rise?	0.88	0.44
12. When a wind blows from the west, to which direction does a balloon fly?	0.62	0.44
13. When you face to the north, which direction does your right hand point?	0.47	0.50
14. Memory of a sentence	0.61	0.47
15. 18+19	0.53	0.61
16. 32−16	0.33	0.45
17. Regular sequence: 3648	0.58	0.50
18. Reverse sequence: 92	0.83	0.63
19. Reverse sequence: 246	0.57	0.53
20. Reverse sequence: 7185	0.21	0.40

judging the extent of senility. If there was a disagreement between the two psychiatrists, a third psychiatrist mediated to give a decision.

As factors which might influence dementia or the test score, age, sex, educational background, and the period of being institutionalized were also investigated.

3) Results

1. Rate of Correct Response and Frequency Distribution for Each Item: The rate of correct response varied as shown in Table 1 from the order of 20% to that of 80%.

2. Reliability: In order to examine the reliability of the test, we tried to find Cronback's coefficient, which is an index of internal consistency of test. The result was as high as 0.90, and the correlation between the items and total scores was 0.63–0.40 ($p < 0.001$) as shown in Table 1. These results demonstrate that the test items have high internal consistency and reliability.

3. Validity: In examining the validity of the test, we used the above-mentioned clinical diagnosis by psychiatrists, the Hasegawa Scale and MSQ. There were 53 subjects who were clinically diagnosed by DSM-III as dementia, and 147 as normal. The mean score of the dementia group was 7.0 ± 4.5 while that of the normal group 14.5 ± 3.8. The difference in the mean scores between the two groups was significant ($t = 11.67$, $df = 198$, $p < 0.001$), showing that this test is very effective in discriminating the dementia group from the normal group.

We then examined the mean scores and 95% confidence limit of the population mean of "the normal group," "mild senility," "moderate senility" and "severe senility" by Karasawa's Test on senility, and obtained the results as shown in Fig. 1. An analysis of variance showed significant differences in the mean scores of the groups ($F = 47.225$, $df = 3$, $p < 0.001$), and group differences were also significant. The boundary scores between the normal and mild senility were 14 and 15 points, those between mild

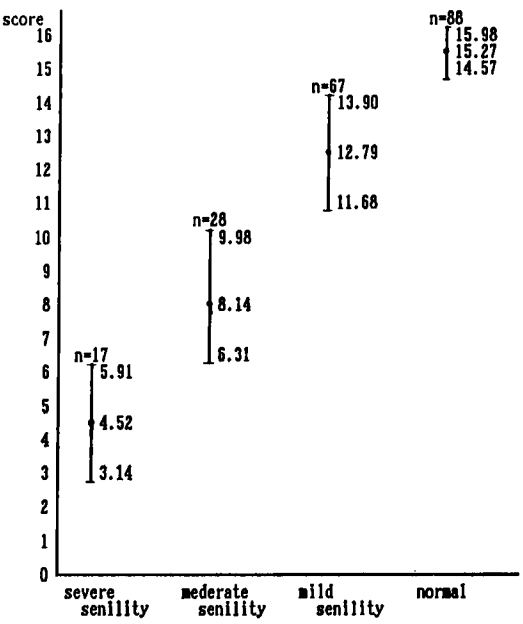

Fig. 1: Karasawa's senility degree and mean score.

senility and moderate senility 11 and 10 points, and those between moderate senility and severe senility approximately 5 and 6 points.

Comparisons were also made between the Hasegawa Scale and MSQ to examine the validity, and thus we obtained the correlations of 0.89 ($p < 0.001$) with the Hasegawa Scale and of 0.84 ($p < 0.001$) with MSQ.

4. Dementia Diagnosis Criteria of the New Screening Test: Examining the frequency distribution of the dementia group and the normal group by the DSM-III dementia diagnosis (Fig. 2), we found that they were substantially discriminated into dementia and normal groups between 10 and 11 points. We also examined the mean scores of diagnostic criteria of Karasawa's Senility Degree for each group, and found that those below 10 points included "moderate senility" and "severe senility." We, therefore, considered 10 points was an appropriate cutting point.

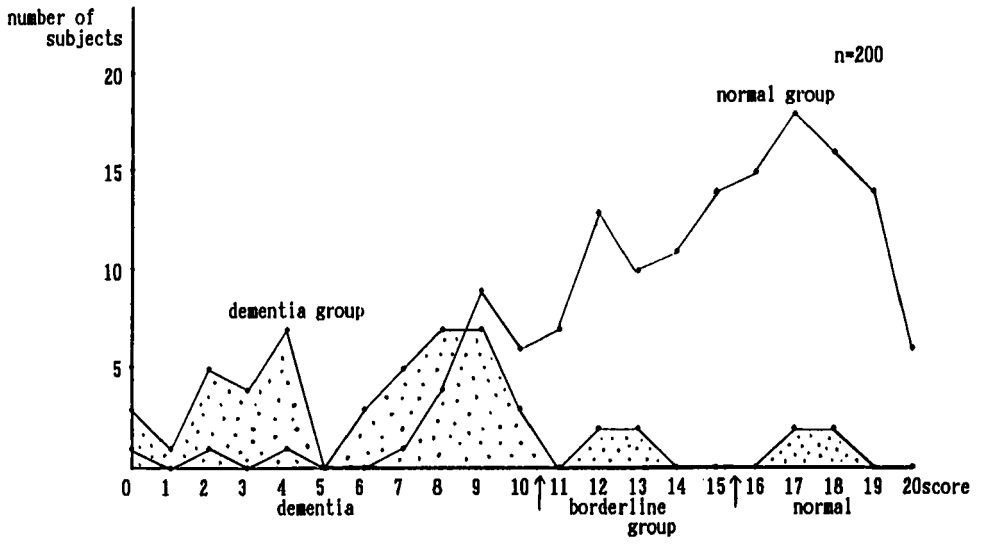

Fig. 2: Frequency distribution of the dementia group and the normal group by DSM-III.

In this case, both the sensitivity and specificity showed high values of 84.9% and 84.5%, respectively, while the rate of misdiagnoses was as low as 15.5%, further confirming the validity of this point as a cutting point. We also defined that the range between 11 and 15 points as the borderline group between dementia and normal.

Thus, those in the range of 0–10 points were diagnosed as the dementia, 11–15 points the borderline group, and over 16 points the normal subjects.

We then tried to find the correlation coefficients between the test score and the age, sex, educational background and the period of being institutionalized. With age, the correlation coefficient was as low as -0.23, with sex -0.01 which is close to 0 and not significant, and with educational background 0.12 which was not significant. The correlation coefficient with the period of being institutionalized was -0.07.

DISCUSSION

The present test was demonstrated to have high internal consistency and reliability to effectively discriminate the dementia group and the normal group distinguished by the DSM-III dementia diagnostic criteria indicating a high validity, and to highly discriminate groups according to Karasawa's Senility Degree, particularly for discrimination of the normal aging and dementia, thus meeting the urgent need for efficiently discriminating "mild senility" and "moderate senility." The high correlation with the Hasegawa Scale and MSQ further demonstrates efficacy of the test as a screening test for dementia. The fact that the correlation between the test and demographic factors such as age, sex, educational background and the length of being institutionalized was low shows that the score of this test is independent and is not easily affected by these factors. Most of the conventional dementia rating tests were framed to discriminate the demented elderly from the normal aged or to rate the degree of dementia by measuring the intellectual capacity. These tests mostly utilized items frequently used clinically for discriminating dementia or those of intelligence tests, and their contents were mainly items related to memory, time, place, orien-

Table 2: N.I.M.H. Screening Test for Dementia

Name: _____ M/F Examined on: _____
Examined by: _____

Question (Correct Answer or Method of Scoring	Answer	Correct ○ Wrong ×
Tell me the date of your birth. (Score separately for the year and the date. The era is not scored.)	Year Month/Date	
What day of what month is it today? (Score separately for the month and the date.)	Month Date	
What day of the week was it yesterday?	Day	
What day is May the fifth? (The Children's Day, The Iris Festival, The Boy's Festival, The Japanese Iris Festival.)		
When is Coming-of-Age Day? (January 15th)		
With what color of a signal do you cross the road? (Green)		
What do you call an elder sister of your mother in general? (Aunt)		
What do you call a daughter of your younger sister in general? (Niece)		
From which direction does the sun rise? (East)		
When a wind blows from the west, to which direction does a balloon fly? (East)		
When you face to the north, which direction does your right hand point? (East)		
Now, I will read a sentence. When I finish and say "hai," please repeat the sentence. (Read slowly.) "Each and all cooperate and pull a rope." (One error is counted a wrong answer.)		
What is 18 plus 19? (37)		
What is 32 minus 16? (16)		
Now, I will read figures. When I finish and say "hai," please repeat them. (Read slowly.) (In regular sequence) 3-6-4-8		
Now, I will read figures again. When I say "hai," please repeat them in reverse. (In reverse sequence) (1) 9-2 (2) 2-4-6 (3) 7-1-6-5		
	Score (Number of ○)	

▲ Matters to be confirmed:
Date of birth: Meiji, Taisho, Showa Year Month Date Year old
Current address: _____
Past medical history: _____

▲ Judgment and Guideline:

Score	Judgment	Guideline
0–15 points	Dementia suspected	Strongly suspected of being a dementia. Please see a specialist without fail.
11–15 points	Borderline	Suspected of being a dementia. Recommend to see a specialist.
16–20 points	Normal	There is no problem at present.

tation of person, mental control and personal information.

Among them, the most frequently used dementia rating scale in Japan is the Hasegawa Scale. This scale is described to have been developed for screening the demented elderly out of the elderly with normal intellectual functioning. The concurrent grading of 4 levels is as follows; normal, borderline, predementia and dementia. However, it is not clear whether the test is intended for screening the demented elderly, or discriminating the dementia and the normal or grading the elderly by various levels from the normal to dementia. In contrast to the Hasegawa Scale, the test developed by us aims at accurately screening of those suspected of dementia. We first defined the concept of dementia clearly using the DSM-III diagnostic criteria and completed a scale having such items which would contribute to discrimination of dementia in its early phase. We believe that this screening test is different from the conventional dementia rating scales in that as new items for rating judgment and thinking capability are added, which are considered the key functionings of intellectual faculties, the accuracy of dementia discrimination is enhanced. The method has also been improved; in view of the elderly subjects, the test was designed to be over within 10 minutes, no tools are required, the examiner can assess the subjects only from their date of birth, the scoring is simple and no time limit for the test is set.

Table 2 shows the items of this test. As these may possibly include the elderly whose scores were low because of a deterioration of mental functionings such as disturbance or mild cloudiness of consciousness or depression as well as mental retardation among the screened elderly, we indicated the criteria for judging the dementia group, the borderline group and the normal group by the test scores, and gave the guideline for the results obtained.

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