

THE REVISED HASEGAWA'S DEMENTIA SCALE (HDS-R) --- EVALUATION OF ITS USEFULNESS AS A SCREENING TEST FOR DEMENTIA

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SUMMARY

Revised Hasegawa's dementia scale (HDS-R), consisting of 9 simple questions with a maximum score of 30, was examined in its usefulness for screening age-associated dementia in a total of 157 subjects: 95 demented patients and 62 non-demented persons. The two groups were age-matched. Cronbach's coefficient alpha was as high as 0.90 in HDS-R. In addition, the coefficient of correlation of each question's score to the total score of other questions in the HDS-R was significantly high, ranging between 0.79 and 0.40. These findings proved that the HDS-R could satisfy the fundamental prerequisite for dementia screening tests: reliability in terms of internal consistency. Clinical applicability of the HDS-R was confirmed by the following two findings. (a) Significant differences were noted between the demented and non-demented groups in each question's score, total mean score and mean score by GDS-based severity. (b) Dementia could be most exactly discriminated from non-dementia with sensitivity of 0.90 and specificity of 0.82 at a cutoff point of 20/21. The coefficient of correlation of the HDS-R to the MMSE was as high as 0.94, proving the HDS-R to be valid in terms of compatibility with the established dementia screening test. In conclusion, the HDS-R can screen dementia at the highest conceivable accuracy and efficiency. It may also serve to assess the severity of dementia changing with time and the effect of pharmacotherapy and rehabilitation.

Keywords: dementia, screening test, HDS-R, sensitivity, specificity

INTRODUCTION

Since the primary symptoms of dementia are cognitive decline, various intelligence tests such as the WAIS (Wechsler Adult Intelligence Scale) have been used for its assessment. However the WAIS is not generally suitable for screening for dementia since it takes too long to administer, and has not been adequately standardized for elderly subjects with cognitive changes associated with normal aging. For the purpose of screening for dementia, questions should be easily answered by normal elderly persons, but individuals with dementia should find them difficult. Ideally, there should be a standardized, simple, and quick test of cognitive function for routine use by the physician. Many simple scales for assessment of dementia have been developed and are currently in use. Of these, the Mini-Mental State Examination (MMSE) of Folstein et al. (1975) and the Dementia Rating Scale of Blessed et al. (1968) are perhaps the most widely used brief instruments for assessing severity. Hasegawa et al. (1974) developed and standardized a brief dementia screening scale, called the Hasegawa's Dementia Scale (HDS) which comprises 11 questions

(Hasegawa 1983). The HDS have been the most widely accepted not only for clinical use in hospitals and elderly nursing home, but also epidemiological surveys in Japan (Hasegawa and Imai, 1989).

However, a recent review of the HDS required us to reconsider some questions and study a feasibility for worldwide use. In consequence, we decided to delete the following five questions because they were judged to be obsolete or lacking universality:

1. The place of the subject's birth (since it is impossible to confirm without the presence of the subject's family).
2. The year of the termination of World War II in Japan (since it is not appropriate for international use and not even applicable to Japanese population).
3. The number of days in one years (since it is very easily answered even by patients with dementia).
4. The name of the present prime minister in Japan (since it is not appropriate for intercultural use).
5. How long have you been here (since it needs advance information from persons around the subject or lacks uniformity in answers among individuals).

Instead, immediate recall of 3 words, delayed recall of 3 words, and list-generating fluency were added. The HDS was reconstructed in this manner and named the revised HDS (HDS-R).

We report here the results of study on the HDS-R with particular reference to reliability in term of its internal consistency, validity in terms of its compatibility with conventional dementia screening tests, and its clinical applicability.

DESCRIPTIONS OF THE HDS-R

The HDS-R as depicted in Appendix 1 was administered by a psychometrically trained examiner. A description of each question by the HDS-R is as follows:

Question 1 [Age]:

Give one point to the answer made correctly or within a deviation of 2 years.

Question 2 [Orientation in time]:

The examiner may ask about the year, month, day and the day of the week either at the same time or slowly one by one. Give one point to each correct answer.

Question 3 [Orientation in place]:

Give two points to a spontaneous correct answer. It is judged to be correct if the subject substantially understand where he/she is, although he/she cannot exactly say the name and address of the hospital, the office or his/her house where he/she is now.

If a correct answer cannot be gotten, ask the subject 5 seconds later: "Is this a hospital, or office or your house?" Give one point to a correct answer.

Question 4 [Repeating 3 words]:

Pronounce the three words slowly one by one. After that, ask the subject to repeat them. Give one point to each correctly repeated word.

If a word cannot be correctly repeated, teach at least three times what it is and ask the subject to memorize it. But, if this process ends up with a failure, delete the word delayed recall in Question 7.

Question 5 [Serial subtractions of 7s]:

The first question is "subtract 7 from 100". If the answer is correct, give one point to it and proceed to the second question. If the answer is incorrect, discontinue this question and proceed to next question 6. In second question, do not repeat the correct answer made by the subject to the first question, such as "subtract 7 from 93". If the answer is correct, give one point to it.

Question 6 [Digits backward]:

First, pronounce 3 digits, 6-8-2, slowly at intervals of one second. After that, ask the subject to repeat them backward. If the subject can do this correctly, give one point to the success and proceed to the next. If this ends up with a failure, discontinue this question and proceed to the next Question 7.

Second, pronounce 4 digits, 3-5-2-9, in the same manner as above. After that, ask the subject to repeat them backward. If the subject can do this correctly, give one point to the success.

Question 7 [Recalling of 3 words]:

Recall 3 words in Question 4. Give two points to each spontaneous answer. If the subject cannot well recall word, give

him/her such hints as "a plant" for cherry blossom, "an animal" for cat and "a vehicle" for tram after a short interval time. Do not convey two or more hints at a time; instead, convey them one by one confirming the subject's response. For Example, if the subject cannot remember both "cherry blossom" and "tram", say to him/her, "one was a plant, wasn't it?" If he/she can correctly recall "cherry blossom", give one point to the success. Shortly after, convey a hint to him/her saying, "the other was a vehicle, wasn't it?" If he/she can correctly reproduce "tram", give one point to the success .

Question 8 [Recalling 5 objects]:

Five objects must be ready for use. They are optional, but must be unrelated common objects as in a combination of a watch, a key, a cigarette, a pen and a coin. Put the five objects on the table one by one, calling their names, then take them back and ask for recall. Give one point to each correct answer, regardless of the order of recall.

Question 9 [Generating vegetables]:

Enter in the given space the names of the vegetables the subject calls and avoid double entries. Since this question is intended to observe generating fluency, discontinue the question if the name of the first or subsequent vegetable is not called for 10 seconds. Give 0 point to 0-5 vegetable (s), and for each vegetable name after the 5th one, give to 1 point each.

SUBJECTS AND METHODS

All patients in this study were evaluated at the psychiatric out patient clinic of St. Marianna University Hospital. Patients presenting with complains including memory impairment were given complete dementia evaluations including psychiatric and neurologic examinations and CT scans, MRI and EEG. The clinical definition of our patients was based upon the following procedures: (1) Comprehensive interview with the participant and with a reliable informant and neurological examination, (2) DSM-III-R criteria for dementia and global deterioration scale (GDS) of Reisberg et. al. (1982) for clinical staging of dementia symptoms, (3) Hachinski ischemic score, (4) Mini-Mental Status Examination (MMSE).

Ninety-five patients (31 males and 64 females) had received complete dementia evaluations that met DSM-III-R criteria for a clinical diagnosis of dementia. Of this group, 46 patients met DSM-III-R criteria for primary degenerative dementia of the Alzheimer type (Alzheimer type dementia: ATD) and 49 patients were multi-infarct dementia (MID) presenting with Hachinski ischemic scores over 7 points.

The staging of clinical dementia in patient subjects by GDS was showed that cognitive decline was mild (Stage 3) in 21 patients, moderate (Stage 4) in 23 patients, moderately severe (Stage 5) in 26 patients and severe (Stage 6) in the remaining 25 patients. The patients with very severe cognitive decline (Stage 7) were not selected in the demented subjects because these patients were lost of all verbal abilities, and frequently there was no speech at all, only grunting (Reisberg 1982).

The 62 non-demented persons (16 males and 46 females) were elderly nursing home residents. None of these subjects had a history of memory impairment or neurological disease,

and mental status was intact per a clinical interview.

The average age of demented patients was 75.3 (SD=8.8) years, and that of non-demented persons was 76.9 (SD=8.1) years. Control subjects were matched with demented subjects for age. The average education of these patients and control was 10.1 (SD=3.2) and 8.3 (SD=2.9) respectively. The years of education were significant longer in the demented group than in the non-demented group ($t=-3.25, p<0.001$).

RESULTS

The HDS-R score was little correlation with aging and educational level (Pearson correlation coefficients: $r=0.01$ and $r=-0.02$, respectively).

The control group correctly answered each question of the HDS-R at a very high rate. On the other hand, the demented group showed a low rate of correct answers as a whole except repeating 3 words (Question 4). In addition, there were significant correlation between total score and each item's score, ranging from $r=0.79$ for orientation in time and for recalling 5 objects to $r=0.40$ for the question 4 (Table 1). Internal consistency reliability were computed using Cronbach's for all HDS-R's items. Alpha level was as high as 0.90 in the HDS-R. Furthermore, items interconnections for the HDS-R were reported in Table 2.

Table 2. Item Intercorrelation Matrix for HDS-R

HDS-R item	1	2	3	4	5	6	7	8	9
1	-	.72	.53	.32	.50	.36	.61	.67	.57
2		-	.57	.30**	.54	.48	.71	.74	.63
3			-	.32	.55	.40	.50	.57	.51
4				-	.31	.24*	.29**	.36	.38
5					-	.55	.50	.61	.56
6						-	.36	.46	.46
7							-	.57	.59
8								-	.69
9									-

Note. Expected where indicated, all correlations are significant at the $p<0.0001$ level.

* $p<0.003$ ** $p<0.0002$.

Distribution of score on the HDS-R of demented and non-demented subjects was shown in Table 1. The mean score and standard deviations on the HDS-R for the dementia group was 11.96 (SD=7.70), while that of the control group was 24.27 (SD=3.91). Significant differences were noted between the demented and non-demented group ($t=12.57, P<0.001$). Also, the HDS-R was proved to be able to screen dementia at the highest sensitivity of 0.90 and specificity of 0.82 at a cutoff point of 20/21.

Table 1. Correct response and Cronbach Coefficient Alpha of the HDS-R

HDS-R Items	Correct response (%)		Correlation with Total
	Dementia	Non-dementia	
1. Age	45.3	100.0	.72
2. Orientation (date)			.79
Year	27.4	90.3	
Month	39.0	100.0	
Day	17.9	93.6	
Day of the week	23.2	95.2	
3. Orientation (place)			.66
spontaneous reply	43.2	91.9	
correct reply after	75.8	100.0	
4. Repeating three words			.40
a) Cherry Blossom	61.6	100.0	
b) Cat	88.4	90.3	
c) Train	86.3	100.0	
5. Serial subtractions			.69
100-7	65.3	93.6	
100-7-7	25.3	56.5	
6. Digits backward			.54
2-8-6	50.3	74.2	
9-2-5-3	16.8	35.5	
7. Recalling three words			.69
a) Cherry Blossom			
spontaneous recall	20.0	66.1	
correct recall after cuing	36.8	79.0	
b) Cat			
spontaneous recall	15.8	75.8	
correct recall after cuing	37.9	90.3	
c) Train			
spontaneous recall	3.2	38.7	
correct recall after cuing	32.6	79.0	
8. Recalling 5 Objects			.79
Object 1	79.0	100.0	
2	66.3	98.4	
3	51.6	96.8	
4	27.4	85.5	
5	8.4	45.2	
9. Generating vegetables			.74
vegetables 1	44.2	90.3	
2	32.6	75.8	
3	20.0	72.8	
4	14.7	59.7	
5	9.5	51.6	

Cronbach Coefficient Alpha = .90.

Table 3 . Means for each subject groups by HDS-R

Group	no.	Mean score of HDS-R (SD)
Control	62	24.27 (3.91)
Dementia	95	11.96 (7.70)
GDS's stage		
Mild	21	19.10 (5.04)
Moderate	23	15.43 (3.68)
Moderately Severe	26	10.73 (5.40)
Severe	25	4.04 (2.62)

Analysis of variance (ANOVA) was performed to compare the score of HDS-R between the staging of dementia rating (GDS). ANOVA revealed a significant effect on the HDS-R for GDS groups [$F(4,152)=124.82, P<0.0001$] (See Table3)

The mean score of the MMSE with demented group was 13.78 (SD=7.52) points, which was significantly lower than 23.13 (SD=5.99) points in the non-demented group ($t=12.57, P<0.0001$). The coefficient of correlation of the HDS-R to the MMSE was as high as $r=0.97$. On the other hand, the mean score of the HDS was 14.79 (SD=9.01) in the demented group and 27.75 (SD=3.82) in the non-demented group. There was significant difference between two groups ($t=10.70, p<0.0001$). The coefficient of correlation of the HDS-R to the HDS was also as high as $r=0.92$.

DISCUSSION

A short mental status test is most often needed in the screening of mental impairment in elderly people and in determining the severity of impairment. It is thought that the cognitive function test for the demented aged should meet the following four criteria: (1) The test as a whole should be completed in a short time. (2) Tests requiring timing or speed are not suitable. (3) Verbal tests are preferable to performance tests. (4) The tests items should be answered easily by the normal aged, but should be difficult for the demented patients. Based on these criteria, the HDS-R have been developed as a screening test for dementia with 9 questions and a score range from 0 to 30.

As Crum R.M., et al. (1993) reported that there was an inverse relationship between MMSE score and aging and educational level, it may be unrealistic to expect that the influence of age and education can be fully eliminated in dementia screening tests. In our study, the HDS-R score were not related to both age and educational level. This results suggested that at least in the Japanese elderly population it is not necessary to use correction for aging and educational level in scoring, which makes it easier to use the HDS-R in a community survey of dementia or everyday clinical practice. However, it is an important issue for future research to clarify the influence of aging and educational level on test performance from different cultural / educational backgrounds groups.

The newly developed the HDS-R was found to have excellent internal consistency reliability. In addition, each question's score was significantly higher in the control group

than in the demented group. The results showed that the HDS-R was composed of such questions which were effective to screen dementia because they were easy for the non-demented persons, but difficult for the demented ones, to answer. Correlation coefficient of the item of repeating 3 words with total score of the HDS-R was performed lower than other items. Although the interconnections indicated that all but the item of repeating 3 words on the HDS-R were significantly correlated with one another, this item should not be considered useless. Because this items served to monitor the progression of dementia into its more sever stage.

The most common application of the HDS-R is its use as a screening test for dementia. Using the cut-off point of 20/21, we obtained the sensitivity of 0.90 and the specificity of 0.82 in our subject. Those optimum sensitivity and specificity were achieved by regarding a score of 20 or less as suggestive of dementia. When the value was comparable with sensitivity and specificity values for other tests routinely used in geriatric clinic, the sensitivity and specificity of the MMSE were 0.87 and 0.82, respectively, when scores of 0-23 were regarded as indicative of delirium (Anthony et al. 1982). Also, in this study, the HDS was proved to be able to screen dementia at sensitivity of 0.83 and specificity of 0.82 at a cutoff point of 24/25. In addition, the coefficient of correlation of the total score of HDS-R to that of MMSE and HDS was high respectively. This results confirmed the usefulness of the HDS-R in detecting patients with dementia. However, Dick et al. (1984) emphasized that some cognitively impaired subjects were a total MMSE score more than 23, and some cognitively intact patients scored less than 23. The HDS-R therefore is not an entirely reliable indicator of cognitive function and must be interpreted in the light of all other clinical data.

In conclusion, the HDS-R can screen dementia at conceivable accuracy and efficiency and may serve to assess the severity of dementia changing with time and the effectiveness of pharmacotherapy and rehabilitation. The HDS-R will deserve intercultural application by virtue of universality of its contents. It will gain general acceptance from physicians because of its very simplicity with the utmost rationality and contribute to the everyday psychogeriatric management of demented patients. Also, it is always important to have additional diagnostic tools in arriving at an appropriate differential diagnosis for the memory impairment elderly.

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Appendix 1. Hasegawa's Dementia Scale - Revised (HDS-R)

1.	How old are you? (+/- 2 yrs.)		0	1	
2.	Year, month, date, day? 1 point each.	Year	0	1	
		Month	0	1	
		Date	0	1	
		Day	0	1	
3.	What is this place? Correct answer in 5 sec.:2 points Correct choice between "hospital? office?"		0	2	
			0	1	
4.	Repeating 3 words. 1 point each. (To use only one version per test.) Version A: "a)cherry blossom b)cat c)tram" Version B: "a)plum blossom b)dog c)car"	a)	0	1	
		b)	0	1	
		c)	0	1	
5.	100-7=?If correct, 1 point. If not:skip to item #6. -7 again=?If correct, 1 point.	93	0	1	
		86	0	1	
6.	Repeat 6-8-2 backwards. If not:skip to item #7. Repeat 3-5-2-9 backwards.		0	1	
			0	1	
7.	Recall 3 words. For each words 2 points for spontaneous recall. 1 points for correct recall after category cue	a)	0	1	2
		b)	0	1	2
		c)	0	1	2
8.	Show five unrelated common object, then take them back and ask for recall. 1 point each.		0	1	2
			3	4	5
9.	Name all vegetables that come to mind. No time limit. May remind once. Terminate when there is no further answer after a 10 ₁ sec. interval. For each vegetable name after the 5th one:1 point.		0	1	2
			3	4	5
	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____				
Total score			/30		

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