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A new simple score (ABS) for assessing behavioral and psychological symptoms of dementia

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ABSTRACT

In addition to cognitive impairment, behavioral and psychological symptoms of dementia (BPSD) are another important aspect of most dementia patients. This study was designed for a new simple assessment of BPSD. We first employed a clinical survey for the local community with sending an inquiry letter to all members (n = 129) of dementia caregiver society, and then attempted to create a new BPSD score for dementia with 10 BPSD items. This new simple BPSD score was compared to a standard-detailed BPSD score neuropsychiatric inventory (NPI) for a possible correlation (n = 792) and a time to complete (n = 136). Inter-rater reliability was examined comparing scores between main and second caregivers (n = 70) for AD. Based on the clinical survey for local caregivers, a new BPSD score for dementia (ABS, Abe's BPSD score) was newly created, in which each BPSD item was allotted by an already-weighted score (maximum 1–9) based on the frequency and severity, and was finalized with taking temporal occurrences into account. ABS was filled by the main caregiver with a full score of 44, was well correlated with NPI ($r = 0.716$, $^{**}p < 0.01$) in 792 AD patients (age 78.6 ± 7.0 years, MMSE 19.0 ± 5.9), and took a shorter time as only 56.8 ± 38.8 s ($^{**}p < 0.01$) than NPI score (132.7 ± 94.0 s) with 136 AD patients. A high inter-rater reliability was obtained ($r = 0.964$, $^{**}p < 0.01$) with a little smaller score (0.877 time) of ABS in secondary than the main caregivers. ABS provides a new simple and quick test for BPSD assessment, with a good correlation to NPI but a shorter time, and with a high inter-rater reliability. Thus ABS is useful for evaluating BPSD for mild to moderate dementia patients.

1. Introduction

Dementia is an emerging problem not only in developed countries but also in many developing countries including Asia [1]. Alzheimer's disease (AD) occupies more than 60% of dementia in the developed countries, followed by mild cognitive impairment (MCI), vascular dementia (VaD), dementia with Lewy bodies (DLB), fronto-temporal lobar dementia (FTLD), and other types of dementia. Dementia mainly consisted of 2 neuropsychological problems, namely cognitive impairment (CI) and affective-behavioral change. The latter is currently called behavioral and psychological symptoms of dementia (BPSD).

There are a number of clinical scores to measure CI and BPSD for dementia patients. Among them, mini-mental state examination (MMSE) and Hasegawa Dementia Score-Revised (HDS-R) are common for screening general cognitive function [2,3]. As for BPSD, behavioral pathology in AD (Behave-AD) was proposed at year 1987 [4], Crichton Geriatric Behavioral Rating Scale (CGBRS) at year 1989 [5,6], Dementia Behavior Disturbance Scale (DBDS) at year 1990 [7], neuropsychiatric inventory (NPI) at year 1994 [8], and Troublesome Behavior Scale (TBS) at year 1994 [9]. Although these previous BPSD scores are well established, all of them were designed for detailed examination and thus usually take time.

Because the numbers of dementia patients are quickly increasing in the world, there is a strong need to evaluate BPSD as a quick test in daily neurological/psychiatric or even general medicine clinics. However, there has not been such a simple BPSD score for dementia patients.

Abbreviations: ABS, Abe's BPSD score; AD, Alzheimer's disease; ADAS-Cog, Alzheimer's Disease Assessment Scale—Cognitive Section; Behave-AD, behavioral pathology in AD; BPSD, behavioral and psychological symptoms of dementia; CDR, Clinical Dementia Rating Scale; CGBRS, Crichton Geriatric Behavioral Rating Scale; ChEI, choline esterase inhibitor; CI, cognitive impairment; DBDS, Dementia Behavior Disturbance Scale; DLB, dementia with Lewy bodies; FAB, frontal assessment battery; FTLD, fronto-temporal lobar dementia; GDS, Geriatric Depression Scale; HDS-R, Hasegawa Dementia Score—Revised; M, months; mixD, mixed type of dementia; MMSE, mini-mental state examination; MoCA, Montreal cognitive assessment; NPI, neuropsychiatric inventory; SD, standard deviation; TBS, Troublesome Behavior Scale; VaD, vascular dementia; WAIS-R, Wechsler Adult Intelligence Scale—Revised; WMS, Wechsler Memory Scale.

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Therefore, we have conducted a clinical survey in a local dementia community, created a new simple BPSD score based on the survey results, examined this new BPSD score for dementia patients in comparison to NPI, and compared inter-rater reliability between main and secondary caregivers.

2. Surveys and methods

We first employed a clinical survey for the local community with sending an inquiry letter to all members (n = 129) of the dementia caregiver society in the Okayama Prefecture of Japan. The inquiry form consisted of 10 items of main BPSD, namely, 1) wandering in/outside home, 2) eating or toilet problem, 3) delusion or hallucination, 4) offensive and abusive words, 5) day-night reversal, 6) excitation and agitation, 7) apathy and indifference, 8) depressive and gloomy mood, 9) violent force, and 10) high irritability. In the inquiry, the caregiver can choose any of 10 items if it is found in their patients for frequency, and can choose up to 3 items as the most severe and troublesome BPSD for severity.

Based on their returning inquiries, we analyzed the frequency and severity of the 10 BPSD items in the dementia patients. We plotted each BPSD item on a coordinate field according to the frequency and severity, and gave them already-weighted scores ranging 1–9 as maximum depending on the location of the coordinate field that was divided into 9 subfields. Based on these initial scores, we gave a final grading score for each BPSD item depending on the temporal occurrence of the symptom ranging 0–9, and thus created a new BPSD score sheet.

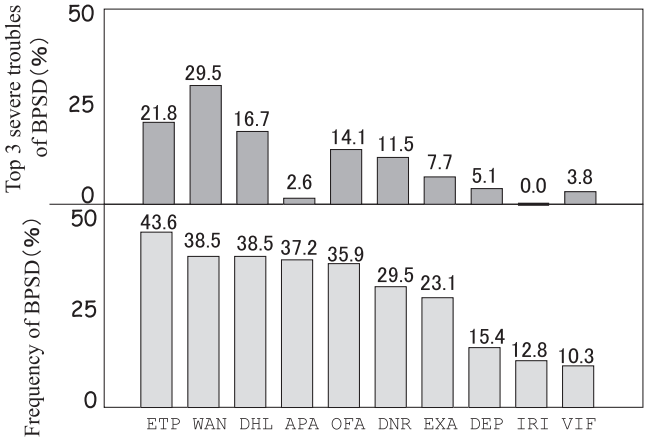
In order to examine a possible relationship between this new BPSD score and a well established BPSD score NPI, both scores were simultaneously examined in 792 AD patients (age 78.6 ± 7.0 years old, MMSE 19.0 ± 5.9, mean ± SD) in our dementia clinics. A part of the AD patients (n = 136) were also examined for the time to complete both this new BPSD score and NPI. To assess the inter-rater reliability, this new BPSD score was newly obtained from pair caregivers (main and secondary caregivers) of 70 AD patients, and compared the scores for a possible difference. Furthermore, MMSE was also examined for a possible relationship between this new BPSD score (891 AD patients plus MCI subjects)/NPI (464 AD patients plus MCI subjects) and a standard screening cognitive score MMSE.

Correlation analysis was performed by non-parametric Wilcoxon Rank Sum test, and the data are expressed as mean ± SD. Data with $p < 0.05$ were considered to be significant. The present study was approved by the Ethical Committee of Graduate School of Medicine, Dentistry and Pharmaceutical Science, Okayama University (#694).

3. Results

Our first inquiry survey collected 81 answers out of totally 129 letters to main caregivers, showing 62.8% of returning rate. In the 81 answers, the dementia patients receiving care were 81.6 ± 9.9 (mean ± SD) years old in average (female rate 70.5%), and 50.0% of them were being cared at home, 29.5% at nursing home or hospital, and 14.5% at both (shuttling home and nursing home/hospital). The main caregivers for the patients were 65.2 ± 11.5 years old in average (female rate 75.6%), who were consisted of 14.8% in husband, 24.4% in wife, 9.0% in son, 25.6% in daughter, 7.7% in daughter-in-law, 3.8% in grandchild, and 14.7% in others. Dementia patients consisted of 77% in AD, 8% in VaD, 5% in DLB, 5% in FTLD, and 5% in mixed dementia (mixD) with an average disease duration of 5 years.

As shown in Fig. 1, a frequency in each BPSD item was 43.6% of eating or toilet problem, 38.5% of wandering in/outside home, 38.5% of delusion or hallucination, and so on (Fig. 1, bottom). On the other hand, the most severe and troublesome BPSD items showed a different pattern, such as 29.5% of wandering in/outside home, 21.8% of eating or toilet problem, 16.7% of delusion or hallucination, and so on (Fig. 1, top).



(Abbreviations: ETP, eating or toilet problem; WAN, wandering in/outside home; DHL, delusion or hallucination; APA, apathy and indifference; OFA, offensive and abusive words; DNR, day-night reversal; EXA, excitation and agitation; DEP, depressive and gloomy mood; IRI, high irritability; VIF, violent force.)

Fig. 1. Frequency (bottom) and severity (top) symptoms of 10 BPSD items obtained from inquiry survey of 81 caregivers for dementia patients. Note the dissociation between the frequency and severity, especially in wandering in/outside home, apathy and indifference, and high irritability.

When the frequency and severity were plotted on a coordinate field according to their data, 7 items showed a slight correlation between the frequency and severity, while 3 items (irritability, apathy, and wandering) did not show such a trend of correlation (Fig. 2). After plotting these 10 BPSD items on the coordinate field, we divided the field into 9 small subfields and gave them initial scores ranging 1–9 as maximum based on the frequency and severity (Fig. 2). After giving these initial scores, we took temporal occurrences such as seldom (practically once a year or less), occasionally (practically once a month or so), sometimes (practically once a week or so), and often (practically once a day or more) into account as another important factor which affects the final scoring. Thus we gave final scores to each BPSD item ranging 0–9, and finally created a new BPSD score with ranging 0–44 from no BPSD (score 0) to full BPSD (score 44) (Table 1).

Simultaneous examinations of this ABS and NPI for the main caregivers of 792 AD patients in our dementia clinics showed a good correlation between the ABS and NPI scores (Fig. 3) with a correlation coefficient of $r = 0.716$ ($^{**}p < 0.01$). There were almost no dementia patients showing the NPI score of more than 80 in our dementia clinics

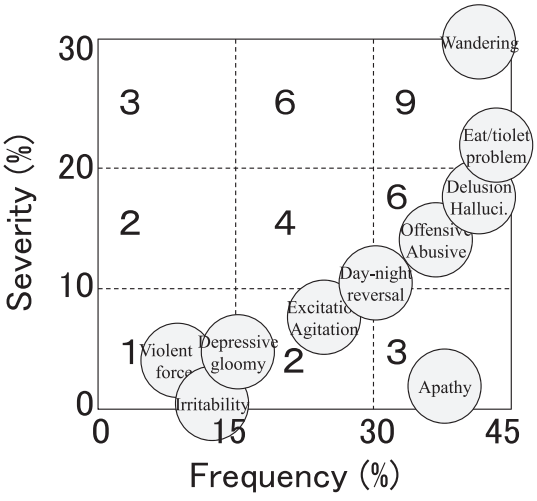


Fig. 2. Plotting 10 BPSD items in the coordinate field depending on their frequency and severity, and 9 subfields of the coordinate were allotted ranging 1–9 as maximum.

Table 1
ABS score sheet.

Inquiry	Seldom	Occasionally	Sometimes	Often
1) Wandering in/outside home	0	3	6	9
2) Eating or toilet problem	0	3	6	9
3) Delusion or hallucination	0	2	4	6
4) Offensive & abusive words	0	2	4	6
5) Day–night reversal	0	2	4	6
6) Excitation & agitation	0	1	2	3
7) Apathy & indifference	0	0	1	2
8) Depressive & gloomy mood	0	0	0	1
9) Violent force	0	0	0	1
10) High irritability	0	0	0	1

Total score 44.

(Fig. 3, horizontal axis), while ABS showed 0–43 points within a full score of 44 points (Fig. 3, vertical axis).

With another study of 136 AD patients in our dementia clinics, an average time to complete either NPI or ABS was 132.7 ± 94.0 s or 56.8 ± 38.8 s (**$p < 0.01$), respectively (Table 2). In the present study, the patients showed an NPI score of only less than 59 (49.2% of full score) and an ABS score of up to 43 (97.7% of full score). Thus almost a full score of ABS took only 42.8% of time for 49.2% of the NPI full score (Table 2). AD patients with an NPI score of less than 10 still took up to 500 s, and those with an NPI score of more than 10 took even longer duration of more than 600 s depending on the NPI score increase.

In terms of inter-rater reliability, the main caregivers for 70 AD patients (36 men and 34 women) consisted of husband (12.9%), wife (42.1%), son (10.0%), daughter (12.9%), daughter-in-law (11.4%), and professionals (5.7%). On the other hand, secondary caregivers were husband (2.9%), wife (0%), son (15.7%), daughter (24.3%), son-in-law (1.4%), and professionals (41.4%). ABS was highly correlated between the main and secondary caregivers with a correlation coefficient of $r = 0.964$ (**$p < 0.01$), but secondary caregivers got a little smaller score (0.877 time) of ABS than main caregivers (Fig. 4). We further performed "intra-rater reproducibility" with new 76 patients (mean age 77.2 ± 6.7 years old, male 43.4%) assessed by the same caregiver for a baseline ABS and a repeated ABS at 1 week later, and found no significant change during the 1 week from baseline 4.8 ± 6.7 (mean ± SD) to 1 week later 4.4 ± 6.5 (p = ns).

Correlations between the MMSE score and ABS/NPI score showed that ABS represented 3–4 points in 891 AD patients plus MCI subjects with an MMSE score of more than 20, which then increased toward the peak of ABS 12 with a decreasing MMSE score to 6–10, and which finally decreased again with a decreasing MMSE score below 5 (data not shown). Similar pattern was observed in the NPI score with 464 AD patients plus MCI subjects with the peak of NPI score 12 at MMSE score 8 (data not shown).

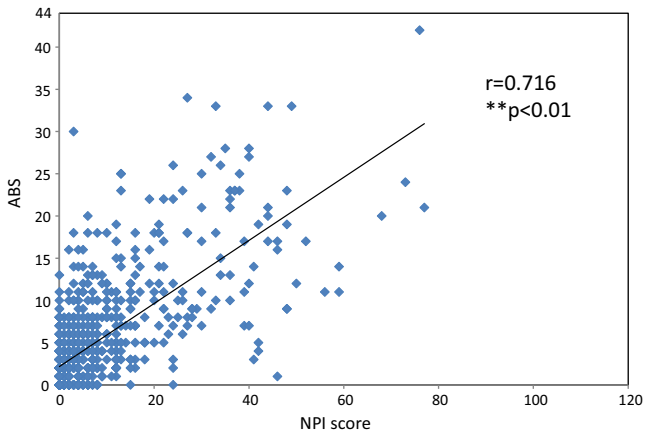


Fig. 3. A good correlation between ABS and NPI scores in 792 AD patients ($r = 0.716$, **$p < 0.01$), and no AD patients with NPI score more than 80 in spite of almost full distribution in ABS ranging score 0–43.

4. Discussion

The present study proposed a new BPSD score for dementia (ABS, Abe's BPSD score). This ABS is newly created based on the current status of BPSD in a super-aged country Japan, is a score already allotted based on the frequency and severity of each BPSD item finalized with taking temporal occurrences into account (Table 1), is well correlated to NPI (Fig. 3), but takes only 56.8 ± 38.8 s (42.8% of time for NPI scoring, Table 2), shows a high inter-rater reliability (Fig. 4), and tends to correlate with MMSE. Thus ABS provides just a simple and quick test for assessing BPSD in mild to moderate dementia patients.

Frequency and severity of BPSD may be different among different racial, cultural and ethnic backgrounds, and even modernizing community change. Such differences may be present between American/Australian and Japanese/Chinese/Taiwan peoples [10–13]. Even within the same Asian people, there are considerable differences from the present Japanese study in 1786 Korean AD patients with higher frequencies of depression (50.6%), apathy (49.6%), irritation (42.0%) and aberrant motor behavior (23.9%) measured with NPI (CREDOS study, ref. 14), and in Shanghai Chinese with higher frequencies of apathy and indifference (62%), followed by agitation and aggression (54%), and hallucination (47%) [13]. Such a difference may also be present within caregivers, where mainland-Chinese caregivers showed a higher depression score followed by Australian-Chinese and Australian white caregivers [15].

For evaluating BPSD, Behave-AD was first proposed, and is characterized by detailed scores for paranoid and delusion (7 items) and illusion (5 items) [4]. CGBRS is characterized by 2 items for mood problems with either subjective or objective symptom [5,6], and is well correlated to Zarit Caregiver Scale [16,17]. Because most DBDS items are positive behavioral symptoms, this score does not well detect psychological and negative behavioral symptoms [7]. The advantage of NPI is similar to ABS (Table 1), where 10 items are already allotted and therefore NPI is currently frequently used for BPSD evaluation in clinical trials with 804 AD patients [8,18]. However, multiplication and summing-up steps take time as shown in the present study (Table 2). TBS is a relatively simple score, but all 15 items are for positive behavioral symptoms and therefore misses psychological and negative behavioral symptoms of BPSD [9].

In comparison to these previous scores, ABS may be the most similar to NPI especially in already allotted 10 items, and the good correlation of

Table 2
Time to complete ABS and NPI scoring in the same 136 AD patients.

	NPI	ABS	p-Value
Time to complete scoring (s)	132.7 ± 94.0	56.8 ± 38.8	**$p < 0.01$
Range of the score (% of full score)	0–59 (49.2%)	0–43 (97.7%)	
Full score	120	44	

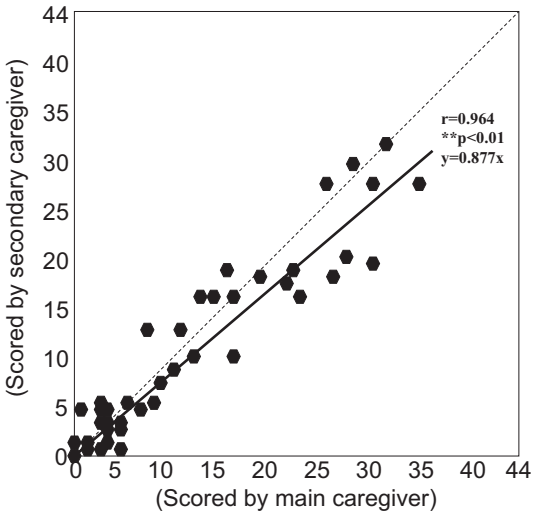


Fig. 4. Plot of ABS between main (x axis: horizontal) and secondary (y axis: vertical) caregivers for 70 AD patients, showing a high correlation ($r = 0.964$, $^{**}p < 0.01$) with a little smaller ABS in secondary than main caregivers ($y = 0.877x$).

ABS to NPI provides a usefulness of ABS (Fig. 3). However, ABS is different from NPI in taking temporal occurrences into account (Table 1), in different maximum scores already-weighted (scores 1–9), in no need of multiplication, and thus in much shorter time to fill out (Table 2) which provides an advantage of ABS for screening BPSD. The dementia patient with less than 20 points in NPI showed the wide variation of ABS scores between 0 and 30 (Fig. 3). Because affective items are not exactly the same between ABS and NPI, and also because the frequency and severity are not again the same between ABS and NPI, there are some variations between the scores. However, the coefficient of $r = 0.716$ ($^{**}p < 0.01$) may be a fair and acceptable correlation between the similar but different scores (Fig. 3).

One interest is that there were almost no patients showing NPI of more than 80 in our neurological dementia clinics (Fig. 3, horizontal axis), where the same dementia patients showed almost a full range of ABS from 0 to 43 (Fig. 3). Another interest is the high inter-rater reliability and the smaller score of ABS in secondary than main caregivers (Fig. 4). The high inter-rater reliability confirms the usefulness of this ABS, and the higher rate of professionals (41.4%) may account for a little smaller score of ABS in secondary caregivers. The reason may be that secondary caregivers (especially professionals) had more distance to the patients than the primary caregivers (especially spouses), which resulted in the small decrease of ABS in the secondary caregivers especially positive BPSD symptoms. Our intra-rater reproducibility also suggested a reliability of ABS.

A limitation of the present study was mainly for mild to moderate AD (MMSE 19.0 ± 5.9) but not severe AD who may show higher ABS and NPI scores (Fig. 3). Thus the question is to be resolved in the future whether if ABS is also useful for severe dementia patients who attend more psychiatric clinics than neurological/general medicine clinics. Another limitation was that our first cohort was not only for AD (77%), but also for VaD (8%), DLB (5%), FTLD (5%) and mixed dementia (5%). However, our analysis showed a good correlation of the other type of dementia to NPI, suggesting that this ABS could also be applied to other types of dementia. On the other hand, BPSD score ranging 0–97.7% is still another advantage of ABS for detecting and monitoring BPSD for mild to moderate dementia. In summary, the present study proposes a new simple and quick score (ABS) for assessing BPSD of mild to moderate AD and other types of dementia [19,20]. ABS could also be useful for evaluating a drug effect on BPSD after a therapeutic intervention in daily clinics.

Disclosure

The authors report no conflicts of interest in this work.

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