Confabulations in remembering past and planning future are associated with psychiatric symptoms in Alzheimer’s disease

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Abstract

Psychiatric symptoms such as delusions and aggression are frequently observed in patients with Alzheimer’s disease (AD), but few studies examined the association of these symptoms with confabulations. We studied 32 AD patients and 10 age- and education-matched healthy older adults. The AD patients were divided into delusion/aggression and non-delusion/non-aggression groups based on their behavioral pathology in AD frequency-weighted severity scale score. Confabulations were assessed using questions about temporality (personal past, orientation, and future planning), and cognitive functions were determined using the mini-mental state examination and the cognitive abilities screening instrument. The AD patients showed confabulations on all types of questions, and their confabulation scores for the past and future were strongly correlated. Cognitive functions were not significantly correlated with confabulation scores for any type of questions. The delusion/aggression group had significantly more confabulations on past and future questions compared to the non-delusion/non-aggression group. These findings suggested that confabulations in remembering the past and planning the future were affected by psychiatric symptoms such as delusion and aggression.

Keywords: Confabulation; Alzheimer’s disease; Psychiatric symptoms; Episodic memory

1. Introduction

Confabulation is an example of irrelevant speech, and is classically defined as “a falsification of memory occurring in clear consciousness in association with an organically derived amnesia” (Berlyne, 1972). Confabulation is often observed in patients with Korsakoff’s syndrome (Berglunt, Gustafson, & Hagberg, 1979; Dalla Barba, Cipolotti, & Denes, 1990) and also occurs in other pathological conditions, including Alzheimer’s disease (AD) (Kern, Van Gorp, Cummings, Brown, & Osato, 1992; Dalla Barba, Nedjam, & Dubois, 1999; Nedjam, Dalla Barba, & Pillon, 2000; Tallberg & Almkvist, 2001; Nedjam, Devouche, & Dalla Barba, 2004).

Previous studies suggested that confabulations might be associated with poor cognitive ability (Tallberg & Almkvist, 2001) or disturbed frontal/executive functions (Cunningham, Pliskin, Cassisi, Tsang, & Rao, 1997). Moscovitch and
Melo (1997) also argued that confabulation was a consequence of a deficit in strategic retrieval resulting from damage to the region of the frontal cortex. On the other hand, Dalla Barba et al. (1997, 1999) pointed out that confabulation scores were not correlated with executive functions and suggested an association with disturbance of personal temporality, rather than frontal/executive functions. Kopelman (1987) proposed two types of confabulation, i.e., spontaneous confabulation and provoked confabulation, and suggested that the spontaneous type resulted from superimposition of frontal dysfunction and the provoked type was common in amnesic patients. However, spontaneous confabulation was difficult to measure and to distinguish from delusion in AD.

These studies only investigated cognitive dysfunctions as potential factors associated with confabulation. However, it was also suggested that confabulation might be closely related to psychiatric symptoms in AD (Johnson, Hashtroudi, & Lindsay, 1993; Lee, Meguro, Tanaka, Yamaguchi, & Ishii, 2004), with confabulation (a sort of memory disorder) and psychiatric symptoms forming a continuum or spectrum (Berrios, 1998; Ozawa, 2000; Lee et al., 2004). For example, Johnson et al. (1993) proposed that both delusional and confabulating patients had reality-monitoring dysfunction of memories and beliefs. However, the relationship between delusion and confabulation in AD patients has not been widely studied, even though such patients commonly have both symptoms.

Psychiatric symptoms such as delusions and aggression were frequently shown in AD patients (Meguro, Yamaguchi, Itoh, Fujiwara, & Yamadori, 1997; Ballard et al., 2001; Tanaka et al., 2003) and played a major role in patient morbidity and ongoing functional decline (Finkel, 2000). Among the symptoms, delusion and aggression were closely related (Cummings, 2000; Eustace et al., 2001; Lopez et al., 2003) and both were associated with earlier institutionalization, greater costs, and increased caregiver burden (Coen, Swanwick, O’Boyle, & Coakley, 1997; Tery, 1997; Kaufer et al., 1998; Keene et al., 1999; Shigenobu et al., 2002). However, the mechanism has not been fully clarified.

We hypothesized that AD patients with psychiatric symptoms such as delusion or aggression would show significantly more confabulatory responses, compared to patients without such symptoms. We also determined whether cognitive ability was associated with confabulation, since previous studies suggested that confabulations in AD might be associated with poor cognitive ability or disturbed frontal/executive functions.

2. Methods

2.1. Participants

Thirty-two patients (five men and 27 women) meeting the clinical criteria of the National Institute for Neurological and Communicative Disorders and Stroke-Alzheimer’s Disease and Related Disorders Association (NINCDS-ADRDA) for diagnosis of probable AD (McKhann et al., 1984) and 10 healthy older adults (six women and four men) were included in the study. All the healthy controls had a clinical dementia rating (CDR) (Hughes, Berg, Danziger, Coben, & Martin, 1982) of 0. Patients with a history of head injury, metabolic disorders, or alcoholism were excluded. All except two of the AD patients were receiving donepezil, four were on antidepressants, and 10 were on antipsychotics. The AD patients were either hospital outpatients ($n = 18$) or institutionalized people in a nursing home ($n = 14$) located in Miyagi prefecture, northern Japan.

Written informed consent was obtained from family members of all participants. The demographics of the participants are shown in Table 1. The healthy and AD groups did not differ significantly in mean age or years of education.

| Table 1 |
|-----------------|-----------------|-----------------|
| Demographics of the participants | Healthy controls | AD patients | $t$-Value |
| $n$ (male/female) | 10 (4/6) | 32 (5/27) |  |
| Age in years (S.D.) | 78 (5.1) | 80.6 (6.7) | 1.10 ns |
| Education in years (S.D.) | 8.5 (0.9) | 8.8 (2.0) | 0.47 ns |

There are no significant differences between the healthy controls and the AD patients in terms of mean age and years of education ($t = 1.1, p = 0.27$; $t = 0.47, p = 0.64$; respectively). AD: Alzheimer’s disease and ns: non-significant.
2.2. Instruments

2.2.1. Confabulation test

We administered the confabulation test invented by Dalla Barba, Cappelletti, Signorini, and Denes (1997) and Dalla Barba et al. (1999), which included three subsections: 10 personal past questions (e.g. “What did you do yesterday?”, “How did you spend New Year’s Day?”); 10 time and place orientation questions; and 10 personal future questions (e.g. “What are you going to do tomorrow?”, “How will you spend next New Year’s Day?”). The responses were classified into “correct”, “I don’t know”, and “confabulation (false answer),” with reference to information collected from caregivers. For example, if a patient answered 3 of 10 questions about the past incorrectly, compared with caregiver information, the confabulation score was 3. Thus, for each subsection the minimum confabulation score was 0 (no confabulatory answers) and the maximum was 10 (confabulatory answers to ten questions).

2.2.2. Neuropsychological tests

The Mini-Mental State exam (MMSE) (Folstein, Folstein, & McHugh, 1975) and the cognitive abilities screening instrument (CASI) (Teng et al., 1994) were conducted for evaluation of cognitive functions. The CASI includes subscales related to frontal lobe function: attention (repetition of three words and two sentences, scored from 0 to 8) and category-based word fluency (the number of names of four-legged animals given within 30 s), concentration/mental manipulation (naming digits backwards and serial subtractions of 3) and six more subscales: orientation, short-term memory, long-term memory, language, visual construction, and abstraction and judgment.

2.2.3. Behavioral assessment using the behavioral pathology in Alzheimer’s disease frequency-weighted severity scale (BEHAVE-AD-FW)

Caregivers were interviewed using the BEHAVE-AD-FW (Monteiro et al., 2001), which consists of 25 symptoms grouped into seven subcategories, including subcategories A and D for assessment of delusion and aggressiveness, respectively. Subcategory A includes seven items: “people are stealing things”, “one’s house is not one’s home”, “spouse is an impostor”, “abandonment”, “infidelity”, “suspiciousness”, and “other delusions”. Subcategory D includes three items: “verbal outbursts,” “physical threats and/or violence”, and “other agitation”. The items were scored for the preceding 2 weeks. The scores for each subcategory were calculated by multiplying the severity rating (0–3) by the frequency (1–4). We divided the patients into those who scored more than 1 point in subcategory A or D (the delusion/aggression group) and those who scored 0 points in subcategories A and D (the non-delusion/non-aggression group) to investigate the relationship between confabulation and psychiatric symptoms.

2.3. Procedure

2.3.1. Statistical analysis

To examine the responses of the AD patients as a whole on the confabulation test, we compared the confabulation scores of the AD group with those of the healthy elderly group. The correlation coefficients between confabulation scores and MMSE and CASI scores were calculated to examine the relationship between confabulation and cognitive function, and confabulation scores were compared between the delusion/aggression and non-delusion/non-aggression groups to investigate the relationship between confabulation and psychiatric symptoms.

A Mann–Whitney U test was used for between-group comparison, with a Wilcoxon test used for within-group comparison. Spearman correlation coefficients were calculated to examine correlations between variables. A level of significance of \( p < 0.05 \) was used in all analyses.

3. Results

3.1. Confabulations in healthy elderly subjects and AD patients

Confabulation scores for the healthy older adults and AD patients are shown in Table 2. The healthy controls answered more than 60% of all questions correctly, and did not show any confabulations. The AD patients gave significantly fewer correct answers than the healthy controls (\(^aU = 1.00, p < 0.0001; \(^bU = 5.00, p < 0.0001; \(^dU = 37.5, p < 0.001\)). The AD patients showed confabulations on all types of questions, and the confabulation
Table 2
Confabulation task performances of healthy controls and AD patients

<table>
<thead>
<tr>
<th></th>
<th>Healthy controls</th>
<th>AD patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct</td>
<td>Confabulation</td>
</tr>
<tr>
<td>Past</td>
<td>9.5 (0.7)(^a)</td>
<td>0</td>
</tr>
<tr>
<td>Orientation</td>
<td>10.0 (0)(^c)</td>
<td>0</td>
</tr>
<tr>
<td>Future</td>
<td>6.2 (17)(^d)</td>
<td>0</td>
</tr>
</tbody>
</table>

Shown are the means (S.D.). AD: Alzheimer’s disease.

\(^a\) U = 1.00, p < .0001.
\(^b\) r_s = 0.73, p < .001.
\(^c\) U = 5.00, p < .0001.
\(^d\) U = 37.5, p < .001.

scores on personal past and future questions were significantly correlated (\(^b\) r_s = 0.73, p < 0.001). Correct and confabulation scores for orientation were not significantly correlated with confabulation scores for any types of questions.

3.2. Confabulations and cognitive functions in AD patients

As Table 3 shows, correct scores for past and orientation questions were significantly correlated with scores for most CASI domains, but confabulation scores for all types of questions did not correlate with scores for any CASI domains.

3.3. Psychiatric symptoms and confabulations

There were no significant differences in mean age or years of education between the delusion/aggression group (\(n = 15\)) and the non-delusion/non-aggression group (\(n = 17\)), as shown in Table 4. Six patients in the delusion/aggression group (40%) had both symptoms, and delusion and aggression scores were significantly correlated (Spearman, \(r_s = 0.52\), \(p < 0.01\)).

No significant differences between the groups were found for all BEHAVE-AD-FW subcategories except for “paranoid and delusional ideation” and “aggressiveness.” The two groups were also comparable in cognitive functions, as assessed by the MMSE and all CASI domains (U-test, \(p > 0.05\)).

The confabulation scores of the two groups are shown in Table 5. Correct scores for the two groups did not differ significantly, but the delusion/aggression group had significantly more confabulations on past (\(U = 62.5, p = 0.013\)) and future (\(U = 75.5, p = 0.045\)) questions.

Table 3
Correlations between CASI domain scores and confabulation scores in AD patients

<table>
<thead>
<tr>
<th>CASI domains</th>
<th>Correct scores</th>
<th>Confabulation scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Past</td>
<td>Orientation</td>
</tr>
<tr>
<td>Long-term memory</td>
<td>0.58**</td>
<td>0.46*</td>
</tr>
<tr>
<td>Short-term memory</td>
<td>0.48**</td>
<td>0.64**</td>
</tr>
<tr>
<td>Attention</td>
<td>0.32</td>
<td>0.36*</td>
</tr>
<tr>
<td>Concentration</td>
<td>0.37*</td>
<td>0.43*</td>
</tr>
<tr>
<td>Orientation</td>
<td>0.65**</td>
<td>0.55**</td>
</tr>
<tr>
<td>Construction</td>
<td>0.49**</td>
<td>0.14</td>
</tr>
<tr>
<td>Abstraction</td>
<td>0.41*</td>
<td>0.51**</td>
</tr>
<tr>
<td>Fluency</td>
<td>0.33</td>
<td>0.45*</td>
</tr>
<tr>
<td>Language</td>
<td>0.31</td>
<td>0.28</td>
</tr>
</tbody>
</table>

CASI: Cognitive Abilities Screening Instrument. Spearman *\(p < .05\); Spearman **\(p < .01\).
Table 4

Delusion/aggression and non-delusion/aggression groups of AD patients

<table>
<thead>
<tr>
<th></th>
<th>Delusion/aggression group</th>
<th>Non-delusion/aggression group</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n ) (male/female)</td>
<td>15 (3/12)</td>
<td>17 (2/15)</td>
</tr>
<tr>
<td>Age in years</td>
<td>79.5 (7.4)</td>
<td>81.5 (6.0)</td>
</tr>
<tr>
<td>Education in years</td>
<td>8.7 (2.0)</td>
<td>9.0 (2.1)</td>
</tr>
<tr>
<td>MMSE</td>
<td>14.5 (5.3)</td>
<td>16.8 (5.3)</td>
</tr>
</tbody>
</table>

BEHAVE-AD-FW subcategories
- A. Paranoid and delusional ideation* 5.6 (4.8) 0
- B. Hallucinations 0.3 (0.7) 0.2 (0.2)
- C. Activity disturbances 3.0 (4.5) 3.2 (3.5)
- D. Aggressiveness 2.7 (4.1) 0
- E. Diurnal rhythm disturbances 1.2 (2.2) 0.9 (1.7)
- F. Affective disturbances 0.8 (2.1) 0.2 (0.7)
- G. Anxieties and phobias 0.5 (1.6) 1.8 (4.8)

* \( p < .001 \) (U-test).

Table 5

Confabulation test performances of AD patients

<table>
<thead>
<tr>
<th></th>
<th>Delusion/aggression group ( n = 15 )</th>
<th>Non-delusion/aggression group ( n = 17 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past</td>
<td>2.0 (2.3)</td>
<td>5.4 (2.3)\textsuperscript{a}</td>
</tr>
<tr>
<td>Orientation</td>
<td>3.9 (2.4)</td>
<td>2.9 (2.6)</td>
</tr>
<tr>
<td>Future</td>
<td>2.1 (3.4)</td>
<td>4.1 (2.9)\textsuperscript{b}</td>
</tr>
</tbody>
</table>

Shown are the means (S.D.). AD: Alzheimer’s disease.
\( \textsuperscript{a} U = 62.5, p = .013. \)
\( \textsuperscript{b} U = 75.5, p = .045. \)

4. Discussion

AD has predominantly been defined in terms of episodic memory disorders and disorientation, and some AD patients show confabulatory responses, even though others just answer “I don’t know” or “I don’t remember.” In the present study, we examined the relationship between confabulations regarding the personal past and future and psychiatric symptoms or cognitive dysfunctions in AD, with the following results.

First, AD patients showed more confabulations than age- and education-matched healthy controls. Second, AD patients showed confabulations on all types of questions: remembering the past (personal episodic memory), orientation, and future planning (personal future). Confabulation scores for future planning were strongly correlated with those for the past, but not with confabulation or correct scores for orientation. Third, correct scores on the confabulation test were significantly correlated with most CASI domain scores. Orientation CASI scores were especially strongly correlated with correct scores for the three types of questions on the confabulation test. In contrast, no confabulation scores were correlated with any CASI subscores, including those for attention, fluency and concentration, which were considered to reflect frontal lobe functions. Fourth, the delusion/aggression group showed significantly more confabulations on questions associated with remembering the past and future planning, compared to the non-delusion/non-aggression group, whereas there were no significant differences between correct scores for the two groups.

Before making further comments, we note that the number of participants in the study is too small to generalize the results, even though the correlations and significant differences were statistically robust. Interpretation of the results should be viewed in this context.

Our most important finding was that delusional or aggressive AD patients showed significantly more confabulations than those without these symptoms. Several studies suggested that confabulations in AD were associated with poor cognitive ability (Tallberg & Almkvist, 2001), impaired frontal/executive functions (Kern et al., 1992; Cunningham et al., 1997), or disturbance of personal temporality (Dalla Barba et al., 1997, 1999). However, few studies examined the
relationship between psychiatric symptoms and confabulations in AD (Migliorelli et al., 1995; Lee et al., 2004), even though AD patients often have both memory impairment and psychiatric symptoms.

Confabulations in AD might be associated with frontal/executive dysfunction as found in other confabulators (Kern et al., 1992; Cunningham et al., 1997), but we found no significant correlations of confabulations with cognitive functions including frontal/executive functions. This may be because the CASI domains considered reflecting frontal/executive functions were not sensitive enough to detect frontal/executive dysfunction in AD, since most of the frontal/executive function tasks were developed under the hypothesis that other functions in subjects were preserved. In addition, executive function tasks could discriminate AD from frontotemporal dementia, which was characterized by frontal dysfunctions (Nedjam et al., 2004). A second possible explanation for the lack of correlation between confabulations and cognitive functions was that frontal/executive dysfunction was present in AD, but that increased dysfunction did not increase confabulation in AD. Previous studies concluded that frontal/executive functions might be a necessary precursor to confabulation, but more specific factors might account for confabulation in episodic memory (Kopelman, Ng, & Van Den Brouke, 1997; Dalla Barba et al., 1999).

Dalla Barba et al. (1997, 1999) suggested that confabulation might reflect a disturbance of temporal consciousness; that is, confusion in a personal temporal context might lead to confabulatory responses. Our results also showed that AD patients had difficulty in planning for the future, as well as remembering the past. However, scores for the CASI domain orientation were correlated with correct scores on the confabulation test, but not with any confabulation scores. Therefore, orientation ability may be important for remembering the past and planning the future correctly, but orientation dysfunction may not lead to confabulations.

Tallberg and Almkvist (2001) reported that cognitive function can be used as a predictor of confabulation in AD. However, several studies suggested that confabulation on different types of questions (semantic memory questions or episodic memory questions) probably reflected different underlying disorders. Therefore, only confabulation elicited from semantic memory questions might be correlated with cognitive function (Dalla Barba, 1993a,b; Dalla Barba et al., 1999; Lee et al., 2004, 2007). Most of Tallberg and Almkvist’s confabulation tasks consisted of questions about semantic memory or orientation, whereas our confabulation test involved episodic memory and future planning. Furthermore, many studies found no relationship between cognitive dysfunction and psychiatric symptoms in AD (Cummings, 2000; Spalletta et al., 2004). These results suggested that the severity of cognitive dysfunctions might not be related to confabulations. Rather, it might be related to psychiatric symptoms.

Delusion, aggression and confabulation were associated with caregiver stress and early institutionalization (Tery, 1997; Shigenobu et al., 2002; Onishi et al., 2003). However, the neural basis of these symptoms in AD remains poorly understood, despite the importance of the disease. The cause and effect relationships among the three symptoms were unclear, but they may have a common neural basis in the frontal-subcortical circuit (Cummings, 1993; Meguro et al., 1997). Johnson, Hayes, D’Esposito, and Raye (2000) reviewed more than 300 cases of confabulation and concluded that most involved damage to one or more parts of the circuit. Many studies of delusion and aggression in AD also suggested that frontal lobe dysfunctions were related to these symptoms (Venneri, Hsanks, Staff, & Della Sala, 2000; Hirono, Mega, Dinov, Mishkin, & Cummings, 2000; Sultzer et al., 2003; Lancot et al., 2004). Delusion was broadly associated with the presence of aggression (Arsland, Cummings, Yenner, & Miller, 1996; Eustace et al., 2001; Lopez et al., 2003) and some studies suggested that both aggression and delusion shared a common neurochemical or neuroanatomical basis (e.g. deficits in the serotonergic and cholinergic systems) (Procter, Francis, Tratmann, & Bowen, 1992; Mintzer, 2001). We also found a significant correlation between delusion and aggression scores. However, the neural basis of these symptoms and the relationship with causality requires further investigation.

Finally, our study implies that analyses of error types can give useful information. For example, an AD patient may have delusions or aggression if he or she shows many confabulations in a memory test, and the presence of false answers (confabulations) should prompt a clinician to investigate the presence of delusional ideation or aggressive behavior, which may respond to pharmacotherapy. Several studies also pointed out that confabulation or error patterns might be used to distinguish AD from other types of dementia, such as frontotemporal dementia (Thompson, Stopford, Snowden, & Neary, 2005).

References

Lee, E., Meguro, K., Hashimoto, R., Meguro, M., Ishii, H., & Yamaguchi, S. (2007). Confabulations in episodic memory are associated with...


