

Regular Article

Confabulation behavior and false memories in Korsakoff's syndrome: Role of source memory and executive functioning

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Aims: Confabulation behavior is common in patients with Korsakoff's syndrome. A distinction can be made between spontaneous and provoked confabulations, which may have different underlying cognitive mechanisms. Provoked confabulations may be related to intrusions on memory tests, whereas spontaneous confabulations may be due to executive dysfunction or a source memory deficit.

Methods: In 19 chronic Korsakoff patients, spontaneous confabulations were quantified by third-party rating (Likert scale). Provoked confabulations were assessed using the Dalla Barba Confabulation Battery. Furthermore, assessment of executive function was performed using an extensive neuropsychological battery. False memories (i.e. intrusions) and source memory were measured using two parallel versions of

a word-list learning paradigm (a modification of the Rey Auditory Verbal Learning Test).

Results: There were deficits in source memory, in which patients incorrectly assigned previously learned words to an incorrect word list. Also, Korsakoff patients had extensive executive deficits, but no relationship between the severity of these deficits and the severity of confabulation or intrusions on a memory task was found.

Conclusion: The present findings provide evidence for a dissociation between spontaneous confabulation, provoked confabulation and false memories.

Key words: amnesia, confabulation, neuropsychology, source memory.

KORSAKOFF'S SYNDROME IS characterized by severe amnesia in the absence of dementia,^{1,2} and Korsakoff patients typically show profound confabulation behavior.³ Originally these confabulations were regarded as secondary to the amnesia, that is, that patients used confabulation behavior to fill up memory gaps,⁴ but confabulations and amnesia do not necessarily co-occur.⁵ Generally, a distinction is

made between two types of confabulation behavior. First, spontaneous confabulations refer to incorrect memories that patients spontaneously recall without any external trigger, in accordance with which the patient also acts. In turn, provoked confabulations occur when the patient is explicitly prompted for a response, for example in a test setting.⁶ Not only can these two types of confabulation behavior be distinguished behaviorally, but there is also evidence that they have different neurocognitive underpinnings.^{7–9} Spontaneous confabulations are thought to be due to impaired source memory, that is, a deficit in remembering contextual information about an event, and temporal confusion, that is, the difficulty in distin-

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aguishing irrelevant and old memory traces from relevant and new traces referring to the ongoing reality.¹⁰ However, spontaneous confabulation behavior may also be related to executive dysfunction, specifically concept shifting and divided attention,¹¹ or the result of a strategic retrieval deficit.¹² In turn, provoked confabulations are similar to erroneous responses or false memories occurring during neuropsychological testing⁸ and can also be observed in healthy participants.¹³ Most studies examining the neurocognitive mechanisms of confabulation have focused on dementia^{14,15} or ruptured aneurysms.¹⁰ Moreover, to date no study has examined spontaneous and provoked confabulations in combination. In the present study we investigated the role of executive dysfunction, source memory and false memories in both spontaneous and provoked confabulation behavior in patients with Korsakoff's syndrome.

METHODS

Patients

Nineteen Korsakoff patients participated in this study (14 men). Mean age was 58.8 ± 8.8 years. Education level was assessed using seven categories, 1 being the lowest (less than primary school) and 7 the highest (academic degree); mean education level was 4.7 ± 1.2 . All were inpatients of the Korsakoff Clinic of Vincent van Gogh Institute for Psychiatry in Venray, the Netherlands and were diagnosed 1–6 months prior to the investigation. All patients fulfilled the criteria for DSM–IV alcohol-induced persisting amnesic disorder¹⁶ and the criteria for Korsakoff syndrome described by Kopelman.¹ All patients were in the chronic, amnesic stage of the syndrome; none of the patients was in the confusional phase at the moment of testing (i.e. Wernicke psychosis). All patients had an extensive history of alcoholism and nutritional depletion, notably thiamine deficiency, verified through medical charts or family reports. Neuroradiological examination (computed tomography or magnetic resonance imaging) showed signs of brain atrophy and non-specific white-matter lesions in most patients, which are often found in Korsakoff's syndrome but are not a necessary criterion for the diagnosis.¹ None of the patients fulfilled the clinical criteria for alcohol dementia.¹⁷ The study was approved by the local ethics committee and informed consent was obtained.

Materials

Confabulation behavior

The Dalla Barba Confabulation Battery was used, which is a structured interview in which the patient answers 64 questions tapping semantic memory, episodic memory, prospective memory and spatial orientation.¹⁸ All interviews were performed by the same investigator (H.E.K.) and were recorded on audio-cassette. The patients' responses were later scored as correct, incorrect or confabulation, depending on the consistency with information about the patients. This battery has been developed to assess different types of confabulation content and has been validated in clinical populations,^{15,19} but because this battery prompts the patient for an answer, it assesses only provoked confabulation behavior.

Spontaneous confabulation frequency was assessed by the nursing staff of the institution. They were provided with the following definition of spontaneous confabulation behavior: 'Confabulations are the result of erroneous memories. These can be memories of events that never occurred or traces of real experiences that are incorrect with respect to time or place. These incorrect memories do not have the intention to mislead. Spontaneous confabulations occur without an external trigger and occur merely on the basis of spontaneity, that is, the patient acts according to the content of the memory. The question is for you to indicate to which degree this patient confabulates based on his/her current behavior'. Subsequently they were asked to rate the spontaneous confabulation behavior of the patient based on his or her current behavior using a 5-point Likert scale (1, never; 2, seldom; 3, sometimes; 4, often; 5, always).

Neuropsychological assessment

Premorbid verbal intelligence level was estimated with the National Adult Reading Task.²⁰ Executive functioning was measured with an extensive neuropsychological battery tapping all aspects of executive functioning,^{21,22} that is, mental flexibility was measured with the Trail-Making Test, concept shifting and rule detection by the Modified Card-Sorting Test and the Brixton Spatial Anticipation Test, response generation with the Category Fluency test, response inhibition with the Stroop Color-Word Test and planning with the Key Search subtest from the Behavioral Assessment of Dysexecutive Syndrome (BADS) battery. Working memory was measured using the

Digit Span subtest of the Wechsler Adult Intelligence Test–Third Edition,²³ long-term memory was assessed using the Rey Auditory Verbal Learning Test (RAVLT), version A, which consists of a list of 15 words that have to be remembered in five subsequent trials, followed by a 15-min delay, after which a free recall and recognition trial followed.²⁴ The neuropsychological test results were converted to standard scores using the available normative data (i.e. percentiles, deciles, scaled scores, equivalent scores or T-scores).²¹ False memories were measured using the number of intrusions on the free recall trials of the RAVLT.

A modification of the standard test procedure for the RAVLT was used to assess source memory, that is, memory for the context in which the words were presented (list A or list B). Fifteen minutes after having completed the RAVLT-A, the patients were told to forget the A list and were presented with version B consisting of 15 new words that had to be learned in five trials. A recognition procedure followed containing the 15 targets from RAVLT-B, 15 new distracter items and the 15 previous target words from RAVLT-A. The patients had to identify only the target words from the second memory run (RAVLT-B). A correct response was either a hit (a correctly recognized target from the B list) or a correct rejection (a distracter word correctly identified as a new word or a word from the previous A List). Incorrect responses could be an incorrect rejection (a word that was not recognized, but which was actually a target from the B list) or a false alarm. A false alarm occurred if a word was identified as a target from the B list, but which was actually a distracter item from either the newly presented words or the A list that had to be ignored. Subsequently, the number of false alarms from the new distracter words were compared with the old RAVLT-A target words. If more words from the A list than from the new distracter list were incorrectly identified as hits, this would indicate a source memory deficit: patients are able to recognize previously encountered information, but fail to discriminate between information that is relevant to the current context, that is, the ongoing reality, and experiences from the past.

RESULTS

Mean number of provoked confabulations was 17.7 ± 6.4 (range 7–31). The most frequently scored category of spontaneous confabulation behavior was 3 (range 2–5, suggesting that all patients showed spontaneous confabulations). Patients had intact

working memory but profound deficits in long-term memory and executive function (Table 1). Table 2 shows the results for the source memory task. The patients made more false alarms from the RAVLT-A list than from the new distracter items ($t(18) = 6.3$, $P < 0.0005$), but this inability was not correlated with confabulation behavior or any of the neuropsychological tests. The total number of intrusions (i.e. false memories on RAVLT-A and RAVLT-B recall taken together; mean, 14.9 ± 10.3) correlated significantly with the Trail-Making Task interference score (Pearson's $r = -0.54$, $P = 0.022$). Provoked confabulations were positively correlated with Digit Span forward ($r = 0.57$, $P = 0.012$) and Verbal Fluency (animals: $r = 0.45$, $P = 0.05$; professions: $r = 0.58$, $P = 0.01$), but not with total number of intrusions. Spontaneous and provoked confabulations were not correlated and spontaneous confabulations did not correlate with executive function.

DISCUSSION

All Korsakoff patients showed spontaneous confabulation behavior, as rated by the nursing staff, and displayed provoked confabulations. We did not find a correlation between both types of confabulation, in agreement with the notion that spontaneous and provoked confabulations are dissociated.^{6,8} In addition, patients made more false-positive responses on distracter items from the first list, which had to be ignored, compared to new distracter items. This indicates a source memory problem due to temporal confusion. This is in agreement with a previous study in which we found impairments in source memory for temporal order in Korsakoff amnesia.²⁵ Although improvements in memory for temporal context have been shown to be related to recovery from spontaneous confabulation behavior,²⁶ we did not find a correlation between severity of spontaneous confabulations and source memory dysfunction. In a previous study¹¹ we found evidence for a relation between executive dysfunction, that is, mental inflexibility, and spontaneous confabulation in a patient with a thalamic stroke. In the present study, however, we did not observe significant correlations between the severity of spontaneous confabulations and executive dysfunction. However, it should be noted that all patients produced spontaneous confabulations and that the majority of patients (95%) had an impaired degree of perseverative errors indicating a disturbed mental flexibility.

Table 1. Neuropsychological test results for the Korsakoff patients

	Mean	SD	No. impaired patients (%)
NART-IQ [†]	87.8	18.9	–
Digit Span (WAIS-III) [‡]			
Forward	76.5	31.3	0 (0)
Backward	78.2	26.4	0 (0)
Rey Auditory Verbal Learning Test–A [§]			
Immediate recall	20.3	9.6	18 (94.7)
Delayed recall	22.9	13.2	14 (73.7)
Delayed recognition	25.0 [¶]	3.2	14 (73.7)
Trail-Making Test [‡]			
Version A	24.8	32.5	8 (42.1)
Interference score (B compared to A)	32.2	29.5	5 (26.3)
Stroop Color–Word Test [‡]			
Part I	12.9	18.3	10 (52.6)
Interference score (III compared to II)	26.5	18.9	3 (15.8)
Brixton Spatial Anticipation Test ^{††}	3.4	2.1	7 (36.8)
Modified Card-Sorting Test ^{††}			
No. categories	0.8	0.8	7 (36.8)
No. perseverative errors	0.05	0.23	18 (94.7)
Key Search test ^{††}	2.0	1.2	17 (89.5)
Verbal fluency ^{§§}			
Animal naming	3.6	2.0	1 (5.3)
Profession naming	3.5	1.5	3 (15.8)

Impaired patients: >2 SD below the normative mean.

[†]Estimated premorbid deviation IQ; [‡]percentile score; [§]T-score; [¶]raw score; ^{††}scaled score (max = 10); ^{‡‡}equivalent score (max = 4); ^{§§}decile score.

NART, National Adult Reading Task; WAIS-III, Wechsler Adult Intelligence Test–III.

With respect to provoked confabulations, a positive correlation was found with response generation ability (i.e. verbal fluency) and with working memory. Whereas correlations between provoked

confabulations, but not spontaneous confabulation, and verbal fluency have occasionally been found, most studies failed to replicate this.¹⁵ Interestingly, the number of intrusions on a conventional word-learning test was not related to the number of provoked confabulations as assessed with an established paradigm. The number of intrusions has been sometimes regarded as an index of provoked confabulation behavior,⁸ but the present results clearly show a dissociation between false recall on a memory task and provoked confabulation behavior, in line with previous suggestions that intrusions and confabulations may even occur in the absence of one another.²⁷ The number of intrusions was significantly correlated with an index of mental inflexibility. It has been suggested that intrusion errors may be the result of frontal-lobe dysfunction and may thus be related to measures of executive functioning,²⁷ but empiric results are still inconclusive.

Table 2. Source memory results

RAVLT–B measure [†]	Mean	SD
Immediate recall (max = 75)	23.0	8.6
Delayed recall (max = 15)	1.8	1.9
Delayed recognition		
Hits and correct rejections (max = 45)	29.3	3.2
Incorrect rejections (max = 15)	4.4	3.3
False alarms (old targets from A list, max = 15)	9.3	3.9*
False alarms (new distracter items, max = 15)	2.1	2.8*

* $P < 0.0005$.

[†]Raw scores.

RAVLT, Rey Auditory Verbal Learning Test.

There are some methodological issues that need to be taken into consideration. First, it should be noted that the sample size is relatively small to perform correlational analyses, but most evidence to date on the underlying cognitive processes of confabulation comes from single- or multiple-case studies. Additionally, reliable assessment of spontaneous confabulation behavior is difficult. The present quantification was based on third-party ratings because any attempt to assess spontaneous confabulation in the patients themselves can be regarded as a provocation. To our knowledge, however, this is the first study trying to quantify spontaneous confabulations, but future research is clearly needed to further examine the reliability of its assessment. Ideally, an amnesic group of patients with spontaneous confabulations should be compared with another amnesic group without spontaneous confabulation to exclude a relation with mental flexibility and other executive functions.

In all, the current study shows that Korsakoff patients have a deficit in source memory, as well as executive dysfunction. We observed no relation between the severity of spontaneous confabulation and cognitive function. These findings did not corroborate with previous results that indicated that spontaneous confabulations are related to the degree of executive dysfunction.⁹ With respect to provoked confabulations, a positive correlation with response generation ability and working memory was found, but not with the number of intrusions on a verbal memory task. This counters the notion that provoked confabulations may be regarded as similar to false memories (i.e. intrusions on a memory task).⁸ The present findings provide further evidence for a dissociation between provoked confabulations, spontaneous confabulations and false memories (i.e. intrusions), but both in the clinical assessment of confabulating patients and in research papers, these three forms of behavior are often used as synonyms. Future studies should focus in more detail on their relation with executive dysfunction and source memory deficits.

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