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Autobiographical memory in multiple sclerosis

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Abstract

Studies have consistently found that patients with multiple sclerosis (MS) are impaired on tests of anterograde memory, but the status of remote memory in MS remains unclear. To better understand remote memory in MS we administered the Autobiographical Memory Interview (AMI) to 44 MS patients and 19 normal controls matched for age, education, and gender. Additionally, a shortened version of the Famous Faces Test, a test of recall of past U.S. presidents, and a 14-word learning list were administered. Patients performed significantly lower than controls on the learning list and Famous Faces Test, but not on recall of past presidents. On the AMI, patients were significantly impaired on recall of semantic but not of episodic memories. These results indicate that MS patients exhibit retrograde amnesia that cannot be attributed to anterograde memory deficits or lack of exposure to task-relevant information. (*JINS*, 1997, *3*, 246–251.)

Keywords: Multiple sclerosis, Autobiographical memory, Cognition

INTRODUCTION

Previous studies indicate that multiple sclerosis (MS) patients perform poorly on tests of anterograde memory (Beatty et al., 1988, 1989; Rao et al., 1991). Deficits are observed whether the stimuli are verbal or nonverbal in nature, and with both recall or recognition procedures (Rao, 1986; Beatty, 1993).

By comparison, the status of remote memory in MS is less clearly established. In two studies (Beatty et al., 1988, 1989), MS patients were found to be significantly impaired on tests that required the identification of pictures of famous people and recall of public events from the 1940s to the 1970s, and the deficits were of comparable magnitude across all decades. Visual impairments could not fully account for the patients' poor performances since the pattern of results was similar for both the famous faces and the public events schedules, the latter of which was presented aurally in both studies.

By contrast, a larger study (Rao et al., 1991) required participants to recall the last eight U.S. presidents in chronological order. In this study, patients recalled fewer presidents than normal controls, but the difference was not statistically significant.

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A major limitation of all of the above tests of remote memory is that it is impossible to be certain that a failed item was ever actually known by the participant. Hence, it might be argued that the MS patients in the studies by Beatty and colleagues were less likely to attend to and acquire the information about the items tested in the famous faces and public events schedules than were the controls. Although performance by controls in the Rao et al. study was not perfect, it seems reasonable to suppose that all of the participants had at least heard of the recent U.S. presidents. From this perspective, it can be argued that the Rao et al. findings provide a more accurate account of the status of remote memory in MS than does the work of Beatty and colleagues.

Autobiographical memory is a third measure of remote memory that has never been tested in MS. Recently, Kopelman et al. (1989) devised the semistructured Autobiographical Memory Interview (AMI), which requires subjects to recall both semantic and episodic memories from three life periods (childhood, early adult, recent adult). Responses to the interview are verified by personal collaterals (spouses, relatives, etc.) provided by each test-taker.

Because the AMI requires individuals to recall information they definitely once knew this test could clarify the status of remote memory in MS. In the present study we administered the AMI to a sample of MS patients and age-, education- and sex-equated controls. Additional tests of anterograde memory and remote memory were administered in order to allow comparison with previous studies.

METHOD

Research Participants

A total of 44 patients (34 female, 10 male) who met criteria for clinically definite MS (Poser et al., 1983) were recruited from the practices of area neurologists and local MS support groups. All patients were sent a recruitment letter detailing the nature of the study, and were subsequently contacted by phone in order to inquire about their participation and to answer any questions regarding the study.

The patients averaged 11.1 ± 5.8 years of disease since diagnosis and 3.4 ± 2.9 on the Ambulation Index (AI). The AI (Hauser et al., 1983) provides an overall measure of physical disability based on a 10-point scale: 0 (asymptomatic) to 9 (wheelchair-dependent; unable to transfer). Scores from the AI have been shown to be highly correlated with the Kurtzke (1983) Expanded Disability Status Scale ($r = .96$; Beatty et al., 1990).

Nineteen normal controls (15 female, 4 male) matched as a group for age, sex, and education with the patients were recruited from the surrounding community. Patients or controls with a history of neurologic (other than MS), major medical or psychiatric disease, alcohol or drug abuse, or serious head injury (loss of consciousness for more than 1 hr) were excluded from the study. A brief visual screening test excluded subjects with visual acuity worse than 20/70 corrected in the better eye. All participants provided written informed consent prior to participation, and were given the opportunity to be tested either in our laboratory or at their own home; most subjects elected for home testing. No participants were paid for their participation. The research protocol was approved by the University of Oklahoma Health Sciences Center Institutional Review Board.

Procedure

All subjects were administered the Mini Mental State Exam (Folstein et al., 1975) in order to obtain a measure of global cognitive functioning, and the SCL-90–R (Derogatis, 1987), a measure of mood and social adjustment. The SCL-90–R is a 90-item self-report inventory consisting of nine scales, each reflecting different psychological constructs, including (1) Somatization, (2) Obsessive-Compulsive, (3) Interpersonal Sensitivity, (4) Depression, (5) Anxiety, (6) Hostility, (7) Phobic Anxiety, (8) Paranoid Ideation, and (9) Psychoticism. Each item is rated on a 5-point scale of distress from 0 (*no distress*) to 4 (*extremely distressed*). In this study the SCL-90–R was scored and interpreted in terms of these scales and the Global Severity Index, an overall measure of psychological distress. Additional tests used in this study are described below.

Anterograde memory

Memory for new information was tested with a word list consisting of seven low-imagery words and seven high-imagery words known from previous studies to be highly sensitive to memory impairments in MS (Beatty et al., 1988, 1989). Immediately following each presentation of the list, the subjects were asked to recall as many words as possible. Four learning trials and a delayed recall trial (30 min following the fourth trial) were administered.

Remote memory

Famous Faces Test (Albert et al., 1979). A shortened version of this test consisting of fifteen pictures from the 1980s and 10 pictures from the 1990s was administered. Participants were given 30 s to name the person depicted in each photograph. If they answered incorrectly or if they could not identify the individual depicted in the photograph after 30 s they were shown the next photograph.

Presidents Test. Our version of this test first required to recall the last eight presidents of the United States in reverse order beginning with the president currently in office. This task provided two dependent measures, the first reflecting the total number of names of the eight most recent presidents recalled in any order and the second reflecting the order in which the presidents were recalled. The order score was determined only for the presidents that were spontaneously recalled and therefore was not affected by errors of omission. For example, if a participant responded Clinton, Bush, Reagan, Nixon, Johnson, Kennedy, Eisenhower, and Truman, the recall score for name would be 6, but the recall score for order would be 8. Because all participants recalled eight presidents (not necessarily the most recent eight) the order score could be higher than the recall score as in the above example.

Previous studies have shown that MS patients are impaired on tests of temporal memory and sequencing (Beatty & Monson, 1991, 1994). However, memories for item and order information are often correlated. For this reason participants who failed to recall all of the eight presidents in correct order, were given eight 5 × 7 index cards each printed with the name of one of the last eight presidents. Participants were required to place the cards in order according to when each president was in office, beginning with the current president. This latter task was intended to serve as a pure test of sequencing information in remote memory, thereby allowing us to dissociate memory for item information (the names of the presidents) from memory for temporal order. This task provided a third dependent measure for the Presidents Test, reflecting the temporal ordering when the names of the presidents were provided to the subjects. Participants who spontaneously recalled all eight presidents in correct order were assigned a score of eight on this part of the test.

The Famous Faces Test was administered before the Presidents Test to all participants. The two tests contained only one item in common (President Clinton). All control participants and 43 of 44 patients correctly identified Mr. Clinton on the Famous Faces Test and all participants did so on

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the Presidents Test. It is unlikely, therefore, that prior administration of the Famous Faces Test could have contaminated performance on the Presidents Test.

AMI. This test was administered as described more completely elsewhere (Kopelman et al., 1989). Briefly, the AMI utilizes two *schedules* to assess different components of autobiographical memory. The *personal semantic* schedule requires participants to recall semantic memories that are generic in nature (e.g., "What was the name of the high school you attended?"), while the *autobiographical incident* schedule requires participants to recall episodic memories (i.e., specific incidents that occurred in a particular time and place). Both schedules require participants to recall memories from three life periods (childhood, early adult, and recent adult).

Previous research has indicated that patients rarely confabulate on the AMI (Kopelman, 1989). Nevertheless, for the purposes of this study, we attempted to verify all responses to the AMI given by patients and controls by contacting collaterals (e.g., spouses, relatives, etc.) who had knowledge of the participants' lives during the time periods in question. Attempts to verify autobiographical information continued until (1) all information was confirmed or rejected by collaterals, or (2) all listed collaterals denied knowledge of the semantic or episodic information provided by the subjects.

RESULTS

Table 1 summarizes the demographic and clinical data for patients and controls. No significant differences were observed between patients and controls in age, education, or on the MMSE. Patients earned higher scores on all individual scales of the SCL-90–R, but significant group differences were evident only on the Somatization, Depression, Obsessive-Compulsive, Phobic Anxiety, and Psychoticism scales. Patients also attained higher scores on the GSI, indicating a generally higher level of psychological distress.

Table 2 summarizes the performances on the word list and remote memory tests. Patients performed significantly worse than controls on the first learning trial of the word list and on all remaining trials. However, a mixed ANOVA with trials as the repeated measure revealed that acquisition rates on the word list were similar for both groups (Groups $\times$ Trials, $F < 1$). Patients also recalled significantly fewer words than controls on the delay trial but both groups exhibited similar rates of forgetting, as measured by the change in recall from the fourth to the delay trial.

On the Famous Faces Test, patients correctly identified significantly fewer pictures than controls [$F(1,61) = 7.31$, $p < .01$], but the Groups $\times$ Decades interaction was not significant [$F(1,61) = .03$].

Patients performed slightly worse than controls on the recall of names on the Presidents Test, but this difference was not statistically significant. Similar findings were observed for the test of recall of chronological order of the presidents' names and for the card sequencing test.

Results on the AMI are summarized in Table 3. Because performance by controls was at or near ceiling for all temporal periods on both the semantic and incident schedules, nonparametric statistics were employed. In a composite analysis of data from the semantic schedule, subjects were classified into groups that scored 100% on all three temporal periods or attained lower scores (i.e., less than 100% for at least one period). Ten of 19 control subjects (53%) but only 9 of 44 MS patients (20%) attained perfect scores for all periods [$\chi^2(1) = 5.08$, $p < .05$, Yates correction]. Sub-

Table 1. Demographic and clinical measures

	Controls ($N = 19$)	Patients ($N = 44$)	$F(1,61)$
Variable	*M* (*SD*)	*M* (*SD*)	
Age	45.05 (16.55)	45.70 (8.64)	0.04
Education	14.95 (2.20)	14.77 (1.98)	0.10
MMSE	28.84 (1.38)	28.27 (1.68)	1.69
SCL-90–R scale:			
Somatization	0.47 (0.52)	1.35 (0.73)	21.40***
Obsessive-Compulsive	0.96 (0.82)	1.82 (0.96)	11.04**
Interpersonal Sensitivity	0.53 (0.75)	0.95 (0.87)	3.14
Depression	0.61 (0.68)	1.40 (0.90)	11.34**
Anxiety	0.46 (0.53)	0.86 (0.84)	3.43
Hostility	0.43 (0.63)	0.84 (0.84)	3.34
Phobic Anxiety	0.10 (0.24)	0.47 (0.66)	5.31*
Paranoia	0.51 (0.66)	0.78 (0.87)	1.44
Psychoticism	0.24 (0.37)	0.77 (0.78)	7.26**
GSI	0.59 (0.58)	1.09 (0.71)	6.93*

*$p < .05$, **$p < .01$, ***$p < .001$.

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Table 2. Word list learning and remote memory

Variable	Controls ($N = 19$) *M* (*SD*)	Patients ($N = 44$) *M* (*SD*)	$F(1,61)$
Word list recall (maximum = 14)			
Trial 1	5.42 (1.71)	4.55 (1.49)	4.21*
Trial 2	7.42 (1.71)	6.43 (2.39)	2.66
Trial 3	8.95 (1.68)	7.61 (2.36)	4.94*
Trial 4	9.79 (1.84)	8.09 (3.04)	5.09*
Delay	7.79 (2.51)	6.02 (3.24)	4.48*
Trial 4—Delay	2.00	2.07	0.01
Famous Faces recall (percent correct)			
1980s	65.79 (23.74)	50.18 (21.51)	6.56*
1990s	56.84 (23.11)	42.05 (19.60)	6.78*
Presidents Test (maximum = 14)			
Name recall	6.68 (1.53)	6.32 (1.44)	0.82
Order recall	6.42 (2.01)	6.02 (1.91)	0.56
Order recognition	7.00 (1.67)	6.86 (1.49)	0.10

*$p < .05$.

sequent chi-square analyses on the data from the childhood, early adult, and recent adult periods did not reveal significant differences between groups. Thus, the analyses revealed a mild deficit in recalling personal semantic knowledge for the MS patients that was not localized to any particular time period in their lives.

A similar analysis of data from the incident memory schedule showed that 18 of 19 control participants (95%) and 35 of 44 MS patients (80%) attained perfect scores for all three time periods. This difference was not significant ($\chi^2 = 1.30$).

We successfully contacted collaterals in order to verify responses to the AMI for 100% of the patients and controls, but not all collaterals were capable of verifying 100% of the memories reported by each subject. For the control sample, collaterals confirmed the accuracy of 98.47% of the semantic memories and 97.63% of the autobiographical incident memories. For the patient sample, collaterals verified 91.41% of the semantic memories and 89.48% of the incident memories. The difference between groups was significant [$F(1,61) = 4.40$, $p = < .05$] for semantic memories but not for autobiographical incident memories [$F(1,61) = 3.40$, $p > .05$]. These percentages do not represent discrepancies between responses provided by participants and their respective collaterals, but rather represent the inability of some collaterals to verify information from specific time periods. In almost every case this resulted from the fact that the only collaterals available to verify memories to the AMI for some participants were their children, who often remembered hearing stories based on the incident memories, but could not verify semantic information from the participants' childhood and early adult years.

Table 3. Percent correctly recalled on measures of autobiographical memory

Variable	Controls *M* (*SD*)	Patients *M* (*SD*)
Semantic schedule		
Childhood	96.05 (7.44)	89.43 (15.62)
Early adult	97.16 (4.63)	90.34 (10.61)
Recent adult	100.00 (0.00)	99.05 (2.58)
Incident schedule		
Childhood	100.00 (0.00)	92.32 (17.60)
Early adult	100.00 (0.00)	96.93 (12.19)
Recent adult	98.21 (7.80)	97.26 (10.34)

The percentage of agreement between controls and their collaterals for the information that the collaterals could verify was 99.84% for semantic memories and 100% for incident memories. Similarly, the agreement between patients and their collaterals was 99.66% for semantic memories and 100.00% for incident memories. The few discrepancies were minor differences such as a single digit in a street address. These rates of agreement are higher than those reported by Kopelman et al. (1989), suggesting that MS patients and control participants rarely confabulate on the AMI.

Pearson product-moment correlations were computed on the clinical and demographic data, and all measures of cognitive performance. Of the 52 correlations performed, the absolute value of *r* ranged from .00 to .35. None of these correlations was statistically significant, a finding that is less than that expected by chance.

Finally, we considered the possibility that patients' medications influenced test performances. Test performances by patients taking medications with cognitive-impairing properties (benzodiazepines, nonspecific beta

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blockers, or medications with central anticholinergic properties) were compared with performances by patients who either were not taking any medications, or were not taking medications with cognitive-impairing properties (as defined above). Statistical analyses with ANOVAs revealed no significant relationships between use of cognitive-impairing medications and any measure of cognitive performance.

DISCUSSION

In the present study, MS patients were significantly impaired relative to controls in their ability to learn and remember a list of unrelated words and in identifying pictures of famous people. However, patients were not impaired in their ability to recall or sequence past U.S. presidents. All of these findings are consistent with previous reports (Beatty et al., 1988, 1989; Rao et al., 1991), indicating that the patients and controls tested in this study were not atypical. Because all participants received all tests, differences in the pattern of results on the Presidents Test and the Famous Faces Test must be related to characteristics of the tests and not to differences in the patient or control samples. An important new finding, that MS patients are impaired on the semantic memory component of the AMI, was also demonstrated.

Although MS patients achieved higher scores on several scales from the SCL-90–R, no significant correlations were observed between these scores and performances on any of the cognitive tasks. Consequently, it seems unlikely that the patients' remote memory deficits could be attributed to depression or other psychological disturbances.

Nyenhuis et al. (1995) reported that several measures of mood disorders used in MS research contain items that measure general symptoms of MS inadvertently, thus artificially inflating the prevalence of mood disturbances in MS. Similar effects could have occurred in this study, since scales from the SCL-90–R contain test items that could be symptoms of MS rather than indices of psychopathology.

Because the MS patients in this study were significantly impaired on the personal semantic schedule of the AMI, poor performances on tests of remote memory such as the Famous Faces Test and Public Events Test observed in earlier studies (Beatty et al., 1988, 1989) and in this study cannot be attributed to lack of exposure to or failure to learn relevant material.

Moreover, since patients recalled less information from all time periods tested, the deficits in remote memory exhibited by MS patients cannot be attributed to the cumulative effects of deficits in anterograde memory developed since disease onset. Therefore, these data provide the first clear evidence for retrograde amnesia in MS patients. Further, as with earlier studies (Beatty et al., 1988, 1989) old as well as more recent memories were both impaired.

Failures to observe deficits on the Presidents Test and the autobiographical incident schedule can probably be attributed to the brevity of these measures of remote memory. For example, the Presidents Test includes only eight items (*vs*. 25 for this version of the Famous Faces Test), and the autobiographical incident schedule requires generating only three episodic memories from each of the three life periods.

Alternatively, differences in the task demands of the semantic schedule and the incident schedule may have contributed to the differential outcomes on these measures. The semantic schedule requires recall of specific information determined by the examiner, while the memories required on the incident schedule are only loosely constrained. Perhaps using a longer and more highly constrained test of incident memory such as the Crovitz (1970) technique would have revealed deficits in this aspect of autobiographical memory in MS patients.

The majority of episodic memories reported (e.g., running into a barbed wire fence as a child) were personally salient, which likely facilitated recall. Goldstein et al. (1992) tested MS patients' ability to recall important story ideas and found that, like controls, patients recalled more information from prose passages containing ideas of high importance than of low or medium importance. The present results also indicate that recall of important themes from autobiographical memory is largely retained in MS.

For this reason, and because the patients' deficits in recalling semantic knowledge of an autobiographical nature were quite modest, it is not likely that the mild impairments in autobiographical memory detected in the present study will have much impact on patients' abilities to conduct everyday social and other activities.

The present findings also suggest that the AMI may be useful in the clinical assessment of patients with known or suspected memory disorders. Unlike the Presidents and Famous Faces Tests, the AMI requires recall of information that must have been known to patients at one time. Hence, any deficits must be impairments in remote memory. The present findings indicate that the test can detect small differences, at least at the group level, and that confabulation is extremely rare. Earlier findings (Kopelman, 1989; Kopelman et al., 1989) also revealed low rates of confabulation. Taken together, these studies indicate that the time-consuming practice of interviewing collaterals to confirm patients' memories is probably unnecessary, except in isolated cases.

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