PERGAMON

Neuropsychologia 37 (1999) 27–30

NEUROPSYCHOLOGIA

Retrograde amnesia: clinical and methodological caveats

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Received 22 January 1998; accepted 13 May 1998

Abstract

Several clinical and methodological caveats are outlined as they pertain to retrograde amnesia research, and data relevant to these caveats are presented. Three caveats in particular are noted in relation to recently published cases of marked retrograde amnesia; (i) temporal lobe epilepsy may influence memory for news events; (ii) there may be additional, unsuspected pathology in cases of amnesia, such as those with cerebral hypoxia; (iii) degree of media exposure is closely related to performance on the types of news events memory tests that are commonly used in retrograde amnesia research.

Keywords: Retrograde amnesia; Methodology; Epilepsy; Hypoxia; Hippocampus

1. Introduction

The status of retrograde amnesia in the amnesic syndrome is more equivocal and controversial than the status of anterograde amnesia. As noted by Hodges [5] in a recent review; ''Much has been learnt, but uncertainty remains in many areas'' (p. 101). Areas of divergence between studies include the anatomical basis of retrograde amnesia and the presence/absence of temporal gradients in retrograde memory loss, see attached copy (page 29). As Mayes et al. [12] and Kapur [7] have pointed out, it is important to bear in mind clinical and methodological artefacts that may influence performance on tests of retrograde memory functioning.

The purpose of this article is to help clarify some of the apparent contradictions in the literature on retrograde amnesia. In particular, we report data in three specific areas— the role of temporal lobe epilepsy in news events test performance, the detection of additional pathology in cases such as those with cerebral hypoxia, and the role of media exposure in news events memory test performance.

2. Role of temporal lobe epilepsy

Several cases have been reported where patients have a history of temporal lobe epilepsy and have suffered additional pathology, usually ablation of abnormal brain tissue, which has been associated with the onset of an amnesic syndrome. Three reports in particular are worth noting; (i) the case HM [2], (ii) a case of amnesia following surgery for a basal forebrain tumour [13] and (iii) a case of amnesia associated with right temporal lobe ablation [4, 17].

In the case of the patient HM, his retrograde amnesia has sometimes been interpreted as lasting up to 11 years [2, 15]. HM suffered minor seizures since age 10 years, and major seizures since age 16 years. From the age of 16 years, he suffered approximately 10 petit mal (simple partial) seizures a day and one grand mal (secondary generalised) seizure per week. Surgery was carried out when he was 27 years of age (see [3] for a detailed anatomical account of his ablation). Since surgery, HM has suffered one grand mal seizure a year and five petit mal seizures a month. He remains on anti-convulsant medication.

A patient reported by Morris et al. [13] had amnesia following removal of a basal forebrain tumour. She had a long history of probable temporal lobe epilepsy—complex partial seizures over a 25 year period, with EEG investigations showing bitemporal sharp wave discharges occurring independently on both sides. She showed marked impairment on public events memory tests, with no temporal gradient. In addition, she displayed a mild-moderate autobiographical memory impairment for a five year period before surgery.

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S0028–3932/98/$—see front matter
PII: S0028–3932(98)00065–7

A further case was initially reported by Dimsdale et al. [4] and a subsequent post-mortem study of this patient was documented by Warrington and Duchen [17]. The patient initially suffered amnesia following a right medial and lateral temporal lobectomy in 1961. She died in 1986. Post-mortem showed unsuspected left hippocampal pathology. She had suffered frequent grand mal (secondary generalised) and simple partial seizures since the age of 25 years (i.e. since 1932). She showed marked impairments on public knowledge retrograde memory tests.

An assumption underlying these accounts of retrograde amnesia is that temporal lobe epilepsy itself will not have a significant impact on retrograde memory test performance. Although a number of authors [6, 16], including some of those in the articles themselves [2, 15], have alluded to this possibility, to date there have been no firm data that address this point. We report relevant data from a more extensive study of memory function in temporal lobe epilepsy [1].

2.1. Patients

Thirty-three patients with temporal lobe epilepsy (19 of right temporal lobe origin and 14 of left temporal lobe origin), and 33 patients with epilepsy originating outside the temporal lobes, were included in the study. The two groups did not differ significantly on critical variables such as age, educational level, duration of epilepsy or severity of epilepsy. We also included a matched group of 30 normal control subjects, see attached copy.

2.2. Procedure

Subjects were administered a verbal news events questionnaire that covered 49 events occurring between 1980 and 1991. Sample items included, 'Who was the English journalist held hostage in Lebanon who was released in late 1991 (John McCarthy)?' and 'In which London undergound station was there a major fire in 1987 (Kings Cross)?' Questions were read aloud to the subject, who was allowed 30 s to recall the answer. If the subject did not answer a question correctly, four recognition choices were presented. Forty of the items related to events that occurred at a discrete time. Nine questions did not refer to specific events but to activities that were ongoing at the time of the study (early 1990s), and were no longer receiving prominent attention.

The performance of the three groups of subjects is indicated in Table 1. This shows median recall scores and a combined recall and recognition score (Total score). Median rather than mean scores were computed as some variables were not normally distributed. Non-parametric statistical procedures (Kruskall–Wallis and Mann–Whitney tests) were employed, see attached copy.

As can be seen, patients with temporal lobe epilepsy performed at a significantly lower level than normal control subjects and also poorer than patients with epilepsy originating outside the temporal lobes, see attached copy.

3. Role of additional cerebral pathology

Apart from the patient HM, one of the most influential single-case studies of amnesia this century has been the case RB [18], who showed a moderate anterograde amnesia and minimal retrograde amnesia in association with a discrete lesion of the hippocampal formation that was restricted to the CA1 region.

Recently, a case was reported [10] that postulated similar underlying lesions to the patient RB, although the damage in this patient appeared to extend to CA2 fields. The authors reported the presence of severe, ungraded retrograde amnesia in addition to a marked anterograde memory loss. Kartsounis et al. [10] offered a note of caution suggesting that, although detailed MRI scanning indicated only circumscribed structural damage in their patient, it was not possible to exclude subtle histological changes in other areas or remote hypoactivation effects of the hippocampal infarcts, particularly with regard to adjacent cortical areas and the mammillo-thalamic

Table 1
Performance of subjects on the verbal news events questionnaire

Group	Recall median	Total median
Right temporal lobe epilepsy cases (19)	18/49 (Range = 13–23)	35/49 (Range = 30–39)
Left temporal lobe epilepsy cases (14)	15.5/49 (Range = 5.5–24)	33/49 (Range = 26–40)
All temporal lobe epilepsy cases (19 = R, 14 = L)	16/49** (Range = 11.5–23.5)	34/49* (Range = 28.5–39)
Non-temporal lobe epilepsy cases (No. = 33)	25/49 (Range = 16.5–34.5)	42/49 (Range = 35.5–46)
Controls (No. = 30)	26/49 (Range = 21–34)	41/49 (Range = 37–44)

** ($P < 0.001$); * ($P < 0.01$).

system. Further, in view of a recent article [11] that highlighted the presence of additional pathology from PET scanning of a patient with cerebral hypoxia following cardiac arrest—similar to the aetiology of the Kartsounis et al. [10] case—we thought that it would be informative to carry out an FDG PET scan of this patient. Relevant images from this scan are shown in Fig. 1. As can be seen, there was evidence of hypometabolism in right thalamic and right parietal areas, in addition to the hippocampal lesions which were the only relevant detectable abnormalities on the MRI scan. It is of note that the additional lesions found in the Markowitsch et al. patient [10] also included ones in the region of the right thalamus.

4. Media exposure and memory for news events

4.1. Subjects

Nineteen normal control subjects were included for this study (12 men and 5 women). The mean age of subjects was 42 years (range = 31–51 years). The mean predicted IQ, as assessed by the National Adult Reading Test [14], was 112 (range = 94–126).

4.2. Procedure

Short forms of the Verbal News Events Test [8] and the Dead-or-Alive Test [9] were administered to each of the control subjects. For the Verbal News Events Test, subjects were given a list of events, half of which had taken place over the last 30–40 years. The remaining events were plausible but fictitious. Subjects were asked to circle those events that had actually occurred. In the Dead-or-Alive Test, subjects were presented with a list of names of personalities who had become famous during the last 30–40 years, and were asked to circle those who had died.

For each of the tests, a retrograde memory score was calculated by subtracting the number of false positive responses from the total number of correct responses. Each subject's scores for both tests were then summed and a percentage score was calculated. This was based on the total possible score for the two tests (i.e. the total number of real news events and the total number of personalities from the list who had died during the last 30–40 years).

A questionnaire to assess subjects' exposure to the media (e.g. how often they read a newspaper, watched the news on television, listened to the news on the radio, etc.) was also administered. This is detailed in Appendix 1. See attached copy (page 30).

As can be seen in Fig. 2a, there was a significant correlation ($r = 0.76$, $P < 0.001$) between performance on

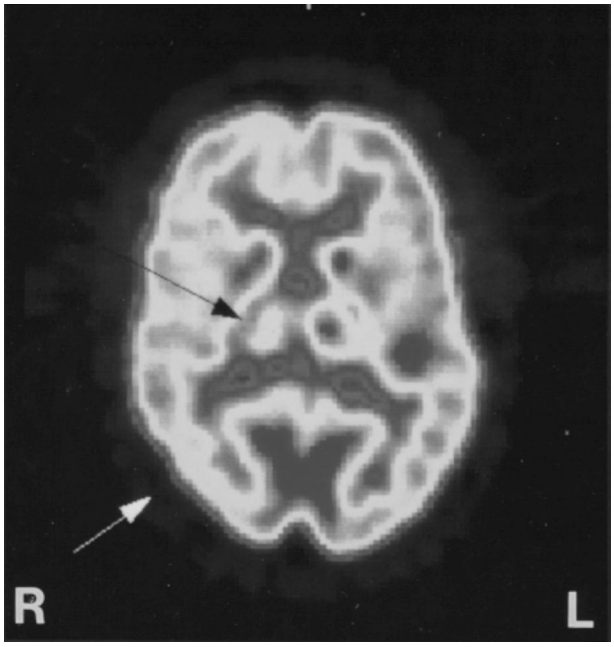

Fig. 1. FDG PET scan showing right thalamic (black arrow) and right parietal lesions (white arrow).

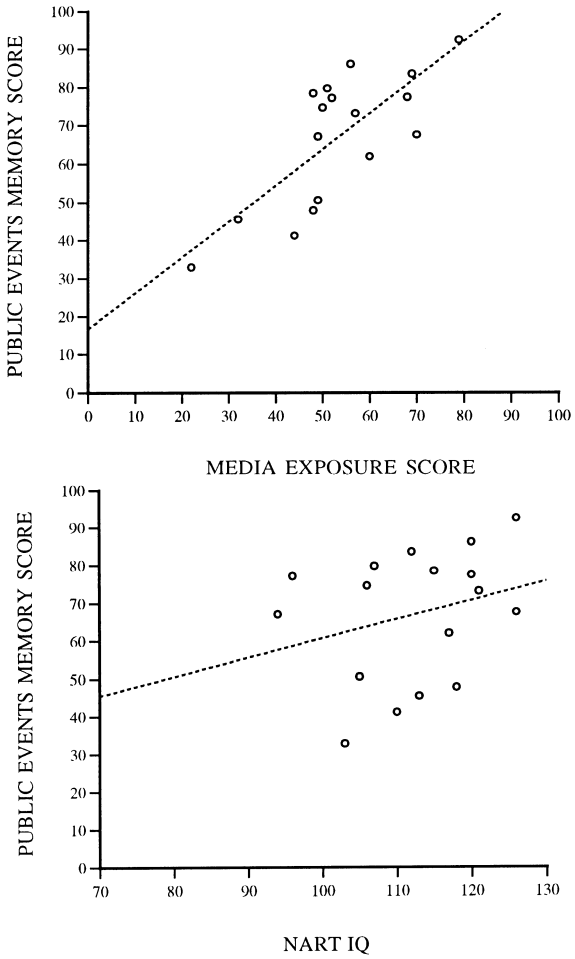

Fig. 2. Scatter-plot diagram showing the relationship between performance on public events memory tests and an index of media exposure (Fig. 2a), and scores on the National Adult Reading Test (Fig. 2b).

the news events memory tests and the index of media exposure. A much smaller, non-significant correlation was found between memory performance and predicted IQ, as assessed by the National Adult Reading Test ($r = 0.28$, ns)—Fig. 2b.

In summary, we have found that the presence of temporal lobe epilepsy may affect memory for news events, that in a case of hypoxia-related amnesia associated with hippocampal lesions on MR imaging there was evidence of additional pathology on PET scanning, and that an estimate of media exposure was more closely related to news events memory test performance than an estimate of IQ. It is quite possible that in some cases of amnesia each of these variables may not, by themselves, be critical in determining the presence or absence of a memory deficit but may interact with other variables which have been present (e.g. prolonged alcohol abuse). We hope that this paper may stimulate researchers to gather data relating to other possible confounding factors as they relate to amnesic syndromes.

Acknowledgements

The support of the *Epilepsy Research Foundation* is gratefully acknowledged.

Appendix

Scoring criteria for media questionnaire

1. Do you generally read a newspaper? **(Max = 20**
   seldom = 5 once a week = 10
   several times a week = 15 every day = 20

2. Which one(s)? **(Scoring weighted according to news content—Max = 24: e.g. each of the broadsheet papers, or one from each group of papers = 24)**
   Daily Papers:
   Guardian, Independent, Telegraph, Times = 6
   Express, Mail = 5
   Mirror, Star, Sun = 4
   Local Paper (e.g. Southern Daily Echo) = 3
   Sunday Papers:
   Independent on Sunday, Observer, Sunday Telegraph, Sunday Times = 3
   Sunday Express, Mail on Sunday = 2
   News of the World, Sunday Mirror, People = 1

3. Do you watch the news on television? **(Max = 20)**
   seldom = 5 once/twice a week = 10
   once a day = 15 several times a day = 20

4. Do you listen to the news? **(Max = 20)**
   seldom = 5 once/twice a week = 10
   once a day = 15 several times a day = 20

5. Do you read books which contain historical facts or details? **(Max = 8)**
   Yes (Often) = 8 No = 0 Sometimes = 4

6. Do you watch films, videos or TV programmes about historical events? **(Max = 8)**
   Yes (Often) = 8 No = 0 Sometimes = 4

   [Has the above trend always been the case?
   Note any difference in earlier years.]

References

[1] Bergin PS, Baxendale SA, Thompson PJ, Fish DR, Shorvon SD. Remote memory in epilepsy. In preparation.
[2] Corkin S. Lasting consequences of bilateral medial temporal lobectomy: Clinical course and experimental findings in H.M. Seminars in Neurology 1984;4:249–59.
[3] Corkin S, Amaral D, Gonzalez R, Johnson K, Hyman B. HM's medial temporal lobe lesion: findings from magnetic resonance imaging. The Journal of Neuroscience 1997;17:3964–79.
[4] Dimsdale H, Logue V, Piercy M. A case of persisting memory impairment following right temporal lobectomy. Neuropsychologia 1964;1:287–298.
[5] Hodges J. Retrograde amnesia. In: Baddeley AD, Wilson B, Watts F, editors. *Handbook of Memory Disorders*. J. Wiley & Sons: Chichester, 1995. p. 81–107.
[6] Kapur N. *Memory Disorders in Clinical Practice*. Butterworths, London,1988.
[7] Kapur N. How can we best explain retrograde amnesia in human memory disorder? Memory, 1997:5;115–30.
[8] Kapur N, Thompson S, Cook P, Lang D, Brice J, Anterograde but not retrograde memory loss following combined mammillary body and medial thalamic lesions. Neuropsychologia 1996;34:1–8.
[9] Kapur N, Young A, Bateman D, Kennedy P. Focal retrograde amnesia: a long-term clinical and neuropsychological follow-up. Cortex 1989;25:387–402.
[10] Kartsounis LD, Rudge P, Stevens JM. Bilateral lesions of CA1 and CA2 fields of the hippocampus are sufficient to cause a severe amnesic syndrome in humans. Journal of Neurology, Neurosurgery, and Psychiatry 1995;59:95–8.
[11] Markowitsch HJ, Weber-Luxenburger G, Ewald K, Kessler J, Heiss W-D. Patients with heart attacks are not valid models for medial temporal lobe amnesia. European Journal of Neurology 1997;4:1–7.
[12] Mayes AR, Daum I, Markowitsch HJ, Sauter B. The relationship between retrograde and anterograde amnesia in patients with typical global amnesia. Cortex 1997;33:197–217.
[13] Morris MK, Bowers D, Chatterjee A, Heilman KM. Amnesia following a discrete basal forebrain lesion. Brain 1992;115:1827–47.
[14] Nelson HE. *The National Adult Reading Test*. NFER-Nelson, Windsor, 1982.
[15] Ogden J, Corkin S. Memories of H.M. In Abraham WC, Corballis M, White K, editors. *Memory Mechanisms*. Lawrence Erlbaum Associates: New Jersey, 1991. p. 200–5.
[16] Squire LR, Alvarez P. Retrograde amnesia and memory consolidation. a neurobiological perspective. Current Opinion in Neurobiology 1995;5:169–77.
[17] Warrington EK, Duchen LW. A re-appraisal of a case of persistent global amnesia following right temporal lobectomy: A clinico-pathological study. Neuropsychologia 1992;30:437–50.
[18] Zola-Morgan S, Squire LR, Amaral DG. Human amnesia and the medial temporal region: enduring memory impairment following a bilateral lesion limited to field CA1 of the hippocampus. The Journal of Neuroscience 1986;6:2950–2967.