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Research report

Patterns of autobiographical memory impairment according to disease severity in semantic dementia

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ABSTRACT

Studies of autobiographical memory in semantic dementia (SD) have yielded either a reversed temporal gradient or spared performances across the entire lifetime. This discrepancy might be owing to the fact that these studies did not take into account disease severity. Our aim was to study patterns of autobiographical memory impairment according to disease severity and to unravel their mechanisms in 14 SD patients, using an autobiographical memory task assessing overall and strictly episodic memories across the entire lifetime. We divided our patients in 2 subgroups of 7 patients each, one mild and one moderate according to their level of disease severity. The results indicated for the mild subgroup selective preserved performances for the most recent time period (last 12 months period) for both autobiographical memory scores. In the moderate subgroup, performances were impaired for both scores whatever the time period. Within-group comparisons across time periods showed a recency effect and a reminiscence bump in the mild subgroup and only a less important recency effect in the moderate subgroup, suggesting that with disease severity, old memories (reminiscence bump) tend to vanish and even recent memories are less well retrieved. A correlation analysis was carried out on the entire group, between the overall autobiographical memory score and performances provided by a general cognitive evaluation (semantic memory, executive functions, working and episodic memory). The results of this analysis reflect that mechanisms of disruption of autobiographical memory in SD predominantly involve a deficit of storage of semantic information in addition to faulty executive retrieval strategies. Finally, our result and those of the literature suggest the existence of 3 distinct autobiographical memory impairment patterns in SD according to disease severity: firstly preserved performances whatever the time period, secondly a reversed temporal gradient with a reminiscence bump and thirdly the appearance of a “step-function”.

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1. Introduction

In 1989, Snowden et al. first introduced the term of semantic dementia (SD, Snowden et al., 1989), also termed the temporal variant of frontotemporal dementia (Edwards-Lee et al., 1997; Hodges and Miller, 2001). SD refers to a form of progressive lobar atrophy related to the inferolateral temporal lobe characterized by the gradual and relatively circumscribed breakdown of semantic memory. In contrast, one of the most striking features of SD patients, at the beginning of the disease, is their preserved day-to-day memory (Neary et al., 1998). As a matter of fact, these patients can usually keep appointments, remember recent visits from family and friends or travel around using public transportation even when their semantic impairment is severe (Moss et al., 2003). Their performances on standard anterograde visual episodic memory tests as the Rey figure test can be normal (Hodges et al., 1999; Perry and Hodges, 2000). However, patients with SD often show deficient performances on episodic memory tests involving verbal material (Hodges and Miller, 2001), reflecting semantic memory deficits, such as comprehension difficulties, rather than genuine episodic memory impairments (Hodges et al., 1999). Classical episodic memory tests only assess anterograde memory, in contrast to autobiographical memory tests which can explore both anterograde and retrograde memories.

Autobiographical memory refers to a collection of memories as well as information related to one's self, particular to individuals, which they have accumulated since early ages and which allows them to construct a feeling of identity and continuity (Conway et al., 1997; Conway and Rubin, 1993; Conway et al., 2004). This type of memory implies different kinds of knowledge pertaining to oneself, either episodic or semantic. Conway and his co-workers (Conway, 1996, 2001; Conway and Pleydell-Pearce, 2000; Conway et al., 2004) described a constructive framework in which the recollection of autobiographical memories which provides access to sensory/perceptual event-specific knowledge (i.e., images and feelings) goes through a personal semantic knowledge base (i.e., life story schema, lifetime periods and generic events) and requires complex retrieval strategies.

Studies of autobiographical memory in SD have yielded mixed results. On the one hand, several investigations of autobiographical memory in SD have pointed the existence of a reverse Ribot's temporal gradient (i.e., preservation of recent memories at the expense of old ones) (Snowden et al., 1996; Graham and Hodges, 1997; Nestor et al., 2002; Hou et al., 2005; Ivanoiu et al., 2006). The majority of these studies (Snowden et al., 1996; Graham and Hodges, 1997; Nestor et al., 2002; Hou et al., 2005) tested SD patients on the Autobiographical Memory Interview (AMI: Kopelman et al., 1989) during which patients were asked to recall autobiographical events and personal semantic facts from 3 time periods: childhood, early adult life and recent life. The results of these studies showed significantly higher scores on the recent life period than for the earlier time periods (i.e., recency effect). Graham and Hodges (1997) and Nestor et al. (2002) used in their single case studies, respectively, in patients AM and JH, a modified version of the Crovitz technique (Crovitz and Schiffman,

1974) based on that described by several authors (Hodges and Ward, 1989; Graham and Hodges, 1997) and claimed that the recency effect was in fact a "step-function" with a relative short period of a few years (before testing) in which memories were relatively well preserved (because more episodic in nature), while all memories that pre-date this cut-off point were impaired (because more semantic in nature). We previously studied in a group of 10 SD patients autobiographical memory by means of an original questionnaire using strict assessment criteria of episodic features of memories (specificity and richness of details) over the entire lifespan (TEMPau task) and we showed not only a preservation of recent memories, but also the existence of a reminiscence bump, which concerns the surge of vivid and important self-defining memories usually acquired between 18 and 30 years (Piolino et al., 2003b).

On the other hand, several studies, some of them using visual material (e.g., family photographs), intended to assess autobiographical memory by overcoming the patient's retrieval deficits due to linguistic deficits or executive dysfunction, have emphasized spared episodic autobiographical memories across the entire lifetime (Moss et al., 2000, 2003; Westmacott et al., 2001; Piolino et al., 2003a; Ivanoiu et al., 2006; McKinnon et al., 2006, but see Graham et al., 2003).

One possible explanation for the conflicting findings might be owing to the fact that these studies did not take into account disease severity when assessing autobiographical memory performances. Ivanoiu et al. (2006) compared the performances of one mild SD patient with those of a moderate SD patient on an autobiographical memory questionnaire which used the basic principles of the AMI (Kopelman et al., 1989) together with a free recall part using the autobiographical fluency method (Dritschel et al., 1992). Their results showed, on the one hand, that the mild SD patient performed at control level for episodic autobiographical memory but showed deficits for semantic autobiographical memory except for the most recent life period. On the other hand, the moderate SD patient was impaired for both episodic and semantic autobiographical memories regardless of the remoteness. Furthermore, McKinnon et al. (2006) examined autobiographical memory using the Autobiographical Interview devised by Levine et al. (2002), which dissociates episodic from semantic retrieval under varying levels of retrieval support in 2 SD patients. They reported evidence for a reversed temporal gradient in the case of low retrieval support but showed preserved autobiographical memory performance when structured probing was provided. Retesting of one patient after 1 year indicated that retrieval support was insufficient to bolster performance following the progression of atrophy to the prefrontal lobe. These 2 single case studies are particularly interesting as they suggest "that cognitive decline should be taken into account when examining the shape of temporal gradient in averaged group data" (Ivanoiu et al., 2006). However, to our knowledge there is no group study on autobiographical memory which has taken into account disease severity in SD. Moreover, the mechanisms of autobiographical memory impairment in SD remain unclear as different hypotheses have been proposed – either a deficit of storage of remote autobiographical memory linked to alterations of temporal neocortex where autobiographical memories could be stored (Graham

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