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Assessing nonverbal memory with the Biber Figure Learning Test—Extended in temporal lobe epilepsy patients

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Abstract

Material-specific memory dysfunction was assessed using a nonverbal, visuospatial, supraspan learning test, the Biber Figure Learning Test-Extended (BFLT-E), in 71 left-hemisphere language-dominant epilepsy patients prior to anterior temporal lobectomy (ATL) and in 48 age-matched healthy subjects. Two matched forms of the BFLT-E yielded comparable scores, indicating that this task may be used to track memory performance over time in individual patients. Right temporal lobe epilepsy (RTLE) and left temporal lobe epilepsy (LTLE) patients performed below healthy subjects on all free-recall measures. RTLE, but not LTLE, patients also differed from healthy subjects in recognition memory discrimination. Furthermore, the RTLE patients performed below LTLE patients on measures specific to long-term memory abilities. The BFLT-E appears to be a useful clinical tool for assessing different components of visuospatial memory in patients with lateralized mesial temporal lobe (MTL) dysfunction. The test is sensitive to visuoconstructional problems associated with various types of brain damage, but it also distinguishes material-specific, nonverbal, visuospatial memory impairments in patients with neurological dysfunction in the non language-dominant right temporal lobe. © 2001 National Academy of Neuropsychology. Published by Elsevier Science Ltd.

Keywords: Temporal lobe epilepsy; Design memory

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The importance of mesial temporal lobe (MTL) structures, especially the hippocampus, in long-term memory has been well-established in studies of humans, primates, and rodents (Zola-Morgan & Squire, 1993). It has been proposed further that in humans unilateral MTL lesions disrupt memory in a material-specific fashion. Most of this evidence comes from investigations of patients who have undergone anterior temporal lobectomy (ATL) for treatment of medically refractory epilepsy. These studies have demonstrated an association between ATL in the language-dominant left hemisphere and deficits on verbal memory tasks such as prose recall, word list learning, and supraspan digit learning (Hermann, Wyler, & Somes, 1994; Milner, 1958; Ojemann & Dodrill, 1985; Rausch & Ary, 1990; Saykin et al., 1992). Other studies have shown a relationship between right ATL and impairments on tasks assessing memory using nonverbal materials, primarily visuospatial stimuli such as unfamiliar faces, abstract designs, mazes, and object–space locations (Jones-Gotman, 1986; Kimura, 1963; Majdan, Sziklas, & Jones-Gotman, 1996; Milner, 1965, 1968; Smith & Milner, 1989). Compared to the robust relationship between verbal memory deficits and left ATL, however, findings of visuospatial memory deficits following right ATL have been weaker and less consistent (Chelune, Naugle, Luders, & Awad, 1991; Lee, Loring, & Thomson, 1989; Malec et al., 1992; Novelly et al., 1984).

One problem in attempting to define the role of MTL structures of the right or non language-dominant hemisphere in visuospatial long-term memory has been the isolation of memory functions from other aspects of cognition. Since multiple regions in both the right and left cerebral hemispheres are implicated in visuospatial, perceptual, and constructional processes, memory tests that engage these more elementary cognitive operations can be disrupted by lesions of either hemisphere (Butters, Delis, & Lucas, 1995; Heilbronner, 1992; Lezak, 1995). The confounding of visuospatial memory performances with impairments in other aspects of visuospatial processing is demonstrated by factor analyses, which have repeatedly found that scores on many standard tests of visuospatial memory load highly on visuoperceptual and visuospatial constructional factors, but have much lower association with measures more clearly defining learning and memory (Larrabee, Kane, Schuck, & Francis, 1985; Leonberger, Nicks, Larrabee, & Goldfader, 1992). Even when a memory factor has been isolated in these analyses, visuospatial memory functions have not emerged consistently as separate from general aspects of memory (Smith, Malec, & Ivnik, 1992).

One way to isolate visuospatial memory processes from other cognitive operations is to design tasks that draw more directly on learning processes. A well-accepted method for assessing various components of long-term memory involves presentation of a supraspan set of stimuli for repeated recall or recognition trials and subsequent testing of delayed retention. This method provides a measure of the capacity for encoding new information into long-term memory by quantifying the degree of improvement in memory over successive presentations of the stimulus set. Problems in memory consolidation are identified by the difference between initial learning performance and delayed retention. Memory retrieval functions are assessed by comparing free-recall and recognition performances. This technique has been adapted for assessing visuospatial memory using designs of moderate complexity that are presented over several learning trials for drawing (Glosser, Goodglass, & Biber, 1989; Jones-Gotman, 1986b; Majdan et al., 1996; Rey, 1968).