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Left Temporal Lobectomy

and

Subsequent Verbal Memory Functions

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Abstract

Neuropsychology has long depended on the use of case studies to illustrate principles of cerebral functioning. For example, the classic case of H.M. illustrated the important role of the temporal regions and the hippocampus in memory functions. For the current paper, a series of neuropsychological evaluations were undertaken with an individual who received a left temporal lobectomy in an effort to reduce intractable seizures. While the surgery was successful, the individual demonstrated a significant gradual decrement in verbal memory functions while maintaining good intellect. The current findings were notably milder than the degree of deficits described for H.M. However, the results of the case study support the significance of the left temporal regions in verbal memory functioning. These findings suggest that continued local cortical stimulation may be necessary for the maintenance of adequate functional abilities in normal verbal memory.
Left Temporal Lobectomy and
Subsequent Verbal Memory Functions

In the mid-1950's, research by Scoville and Milner studied the now famous case study of "H.M.," a young man who suffered from intractable epilepsy, and who underwent bilateral removal of the medial portion of the temporal lobes in an effort to combat persistent seizures. Their findings demonstrated the significant post-operative deficit of recent memory functions, and clearly showed the importance of the temporal region, specifically the hippocampal area, in normal human memory function (Scoville & Milner, 1957).

Current research throughout the years has more clearly identified memory functioning, and has been more specific with regard to lateralization and type of memory deficit. Individuals who had undergone left temporal lobectomies were significantly more impaired on verbal memory tasks than were those who underwent right temporal lobectomies, which resulted instead, in visual memory deficits (Morris, Abrahams, Baddeley & Polkey, 1995). Further research by Rausch & Babb (1993), demonstrated that subjects who underwent temporal lobectomies for intractable epilepsy did not demonstrate a decline in IQ scores, however, the impairment in verbal memory appeared to be notably related to the amount of neuronal cell loss. In comparison, although H.M.'s memory quotient on the Wechsler Memory Scale was significantly impaired at a score of 67, his Full Scale IQ of 112 was estimated
to be in the above average range, and higher than his pre-
operative IQ score of 104 (Scoville & Milner, 1957). In a 14-
year follow-up study of H.M., it was noted that he achieved a
Full Scale IQ of 118 which was significantly higher than pre-
operative and post-operative levels (Milner, Corkin & Teuber,
1968). In contrast, his Memory score of 64 still remained in the
abnormal range of functioning, significantly lower when compared
to his intellectual level (Milner, Corkin & Teuber, 1968).

In August of 1995, R.C., a 43-year old Caucasian male, was
referred for a neuropsychological evaluation. Current status was
that of a post closed head injury (CHI) and a left temporal
lobectomy. Mr. C. is a college graduate, and has been employed
by the government for several years as a technician. His
developmental history is unremarkable, and there was no history
of neurological illness or head injury reported during his
earlier years. However, in 1980, Mr. C. was involved in a motor
vehicle accident and suffered a closed head injury which rendered
him unconscious. As a result of the injury, he was left with no
memory of his two-week hospital stay. In 1985, approximately
five years after the accident, Mr. C. developed seizures. These
occurred approximately once a month, and were intractable to
medication. Mr. C. complained of memory problems which were
directly affecting his job performance. In April of 1991, he
underwent neuropsychological assessment for localization of
lesion.
According to the evaluation results, although lateralization could not be clearly established, there appeared to be a frontal lobe component. This manifested itself in problems with divergent production, response shifting, sequential switching and divided attention. In addition to frontal lobe impairment, a left hemisphere component, specifically associated with temporal lobe dysfunction, revealed a difficulty in verbal learning and retention. The assessment results placed Mr. C.'s performance in the mild to moderate range of impairment. Naming fell into the lower portion of the average range (27th percentile) and was significantly lower than his intellectual level (65th percentile). Verbal associative fluency was less than adequate (<5th percentile), possibly indicative of either a frontal or temporal lobe dysfunction.

In December of 1991, EEG monitoring revealed a mostly left post hippocampal focus and left posterior hippocampal focus. A craniotomy with a left temporal lobectomy followed. Six days afterwards, Mr. C. was discharged with no evidence of neurologic deficit with the exception of a slight hesitation when he spoke.

In 1992, a one-year follow-up post-operative neurological assessment was conducted. In comparison to earlier findings, a similar pattern of intellect and memory was noted as before surgery. Although assessment results demonstrated relatively intact post-operative functioning, there was a slight, but significant fall-off in intellect. Intelligence was estimated at
approximately one-half a standard deviation below pre-operative performance, but was still well within the average range of intellectual ability. Memory assessment revealed that verbal learning had improved, however, visual learning had decreased. Assessment of attention and concentration remained in the average range, however, the greatest difficulty appeared to be the inability to retain newly learned information, which remained significantly impaired. In addition, visual perceptual ability had improved significantly, but spontaneous naming ability had decreased slightly. The results of a MRI scan were also reviewed, and there were no significant internal changes noted. There was also a normal waking EEG. Although Mr. C. engaged in a short course of cognitive rehabilitation retraining, scheduling difficulties made it difficult to keep appointments, and little opportunity for progress was observed.

After reevaluation in 1994, it was determined that surgery had been successful. Mr. C.'s seizures had been reduced to greater than 90 percent, and there was no daily occurrence of seizures. However, nocturnal seizures, consisting of a brief period of confusion and tonic motor activity, did continue to occur slightly more than once per month. However, despite Mr. C's relatively good adjustment and response to the left temporal lobectomy, Mr. C. still complained of a decrease and decrement in memory functioning, which he stated was progressively worsening. Although he used a notebook to aid him in
remembering, his memory problems continued to hamper his job performance, and cause him embarrassment. In 1995, Mr. C. received a follow-up neuropsychological evaluation in an effort to determine what memory functions, if any, were impaired. Comparison would then be made to earlier findings in order to obtain a baseline for his level of functioning.

Results from Mr. C.'s current neurological assessment indicated intellectual functioning was slightly higher than on the post-operative findings, demonstrating an increase in overall intellectual abilities. The assessment data is illustrated in Table 1, and graphed in Figure 1:

Insert Table 1 and Figure 1 about here

This pattern of results suggested more fixed patterns of dementia rather than degenerative. There was noted difficulty when Mr. C. was required to manage long stimulus material relative towards briefer stimulus material. There were also hints of continued problems with memory functions relative towards his verbal skills. In addition, there seemed to be a weak performance on visual-motor coordination tasks such as on the WAIS-R Performance subtests of Block Design, Object Assembly and Coding. There was also difficulty with managing abstract stimulus material relative toward more meaningful stimulus material.
Mr. C.'s performance on Trails A, which requires a simple visual-spatial localization abilities, was mildly weak. This task took 68 seconds, which extended slightly into the severely impaired range. His performance on Trails B was also slow, but only mildly weak at 121 seconds. The most striking area of problems occurred in the memory assessment aspects of the test. On the Memory Assessment Scale (MAS, Williams, 1991), Mr. C. demonstrated globally average functioning, particularly in terms of short-term memory abilities and visual memory functions. However, his verbal memory functions fell significantly over time, and were notably weaker than pre-operative and follow-up assessments. These results are consistent with the H.M. case study, and indicated that R.C.'s memory deficits resulted from a left temporal lobectomy. Like H.M., R.C. also demonstrated a notable impairment in verbal memory functions in the absence of a significant decline in normal intellectual functioning.

The significant drop-off in verbal memory functioning was consistent with Mr. C.'s subjective complaint, and consistent with similar reports from individuals who underwent left temporal lobectomies. It was noted that the fall in verbal memory functioning for Mr. C., while significant, was much milder than reported for the case of H.M. However, because his earlier post-operative verbal memory functioning was superior to pre-operative functioning, it is hypothesized that the lack of local supporting cortical stimulation for the left hippocampus could have influenced this decrement in verbal memory.
References


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