The Effects of Dexamethasone on Cognitive, Speech, and Language Behavior: A Model for the Study of Recovery of Function

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Our presentation today will: (1) Document the improvement in cognitive, speech and language behaviors following the administration of dexamethasone in a case of metastatic brain tumor, (2) Point out the relationship of the PICA profile to the findings on the C.T. scan, (3) Suggest the study of tumor patients as a model for studying the effects of edema and its role in the recovery of function in stroke patients.

In cases of metastatic brain tumor there are numerous reports of improved performance following the administration of steroids. This improvement has been attributed to a reduction in cerebral edema (Eisenberg, et al., 1975; Lokich, 1975; Nelson and Dick, 1975). Improvement has been documented by clinical observations, angiography, other radiological procedures and CSF analysis (Weinstein, et al., 1973; Long, et al., 1972; Reulen and Schurmann, 1972; Ruelen, et al., 1972; Galicich and French, 1961; Fletcher, et al., 1975). No reports of improvement have used standardized neuropsychological or speech and language tests.

A 65-year-old white male was admitted to the Neurology Service, Phoenix Veterans Administration Medical Center with a three-week history of confusion and word finding problems. He had mild right hemiparesis affecting the face and upper extremity, with reduced vibration sense in the distal portion of the right leg. EEG results were abnormal, with slowing over the left hemisphere.

The patient was started on 16mg of dexamethasone daily. This was decreased to 12mg a day after five days and tapered to 8mg a day over the next ten days.

Neuropsychological and speech and language tests were administered on the same day as, but preceding, the initial dose of medication. He was retested five days later and again eleven days later by the speech pathologist. The speech pathologist administered the PICA (Porch, 1971), the neuropsychologist administered the Wechsler Adult Intelligence Scale (Wechsler, 1955), the Purdue Peg Board (Tiffin, 1968) and the Halstead-Reitan Battery (Reitan, undated).

RESULTS

Neuropsychological Tests. At pre-drug administration, the patient obtained a WAIS Verbal IQ of 99, a Performance IQ of 85, with Full Scale IQ of 93 (Figure 1). On neuropsychological measures sensitive to cerebral

dysfunction he exhibited severe impairment, frequently unable to complete the task. He also exhibited numerous motor and sensory problems, primarily involving the right hand. Upon bilateral simultaneous stimulation there was consistent suppression of the right ear. In contrast, there was one such visual suppression in the left field.

Several measures were repeated on second administration, five days later (Figure 1). On Halstead's tests, the more complex measures, there was no improvement, reflecting the continuing presence of the primary lesion. On the WAIS, there was no improvement on the Arithmetic, Digit Span, or Digit Symbol subtests, while there was slight improvement on Block Design, thought to be related to right parietal functioning. Performance on Trail Making showed little change.

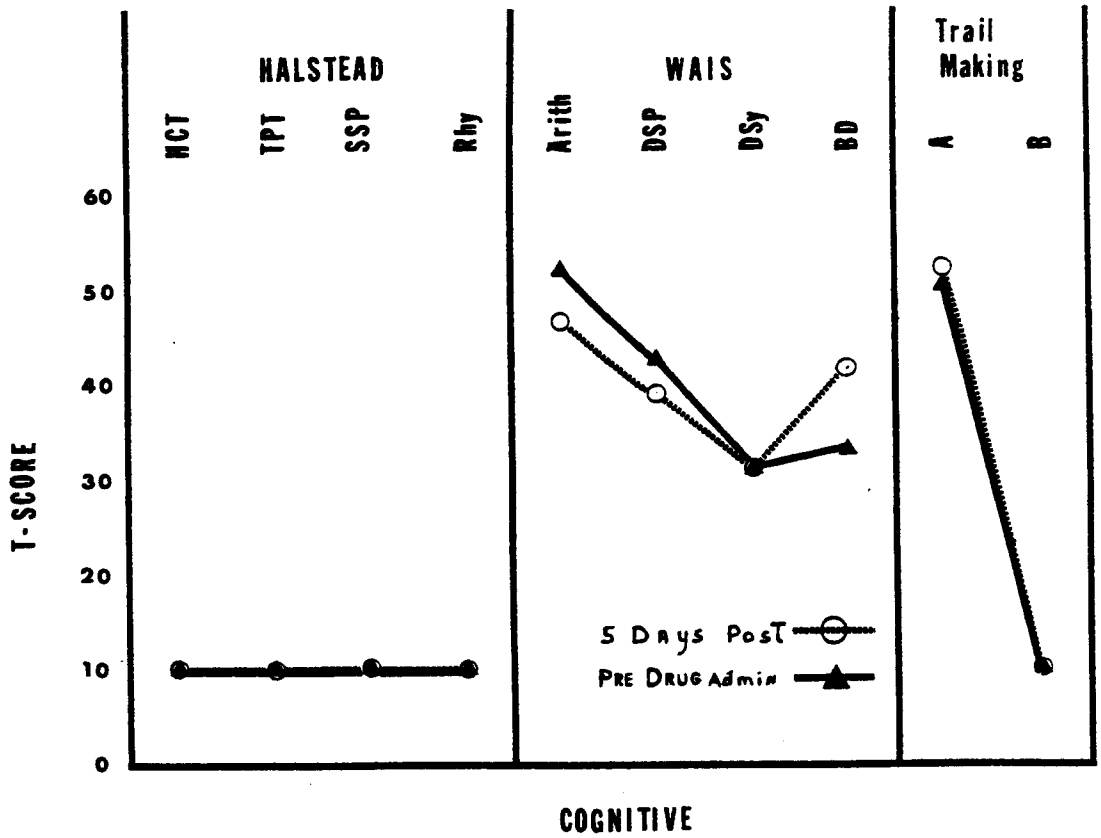

Figure 1. Summary of test results from Halstead-Reitan, Wechsler Adult Intelligence Scale (WAIS), and the Trail Making Test.

In contrast, there were marked improvements in motor functioning, mainly in the speed of the right hand (Figure 2). Similarly, sensory functions also showed marked improvement, with no suppressions in any modality on the right side (Figure 3). Finger recognition improved slightly and graphesthesia improved bilaterally, dramatically on the left. Tactile form recognition time reached normal levels bilaterally.

Thus, there were specific changes in performance with improvement in sensory-motor functions but no real change in higher level cognitive functions.

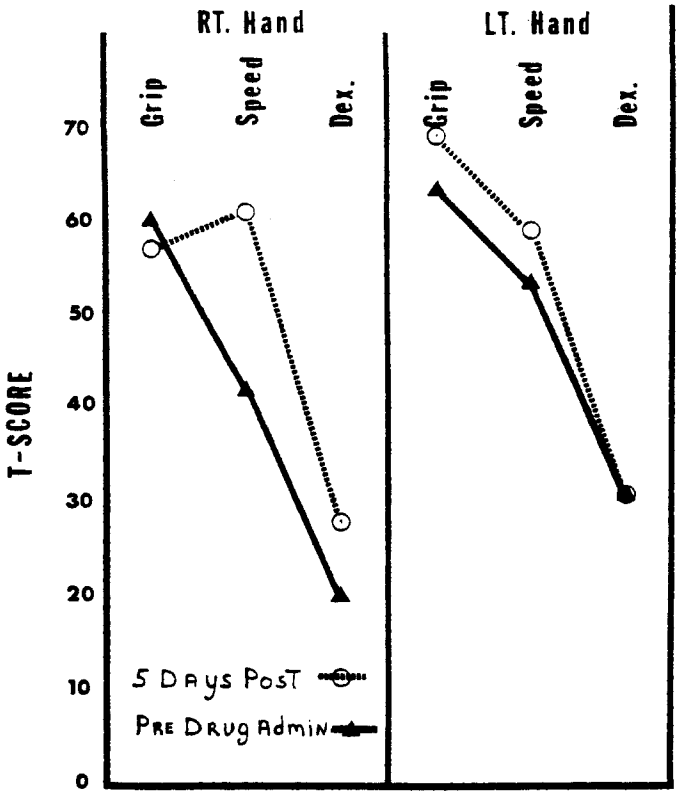

Figure 2. Summary of motor performance tests with the right and left hands.

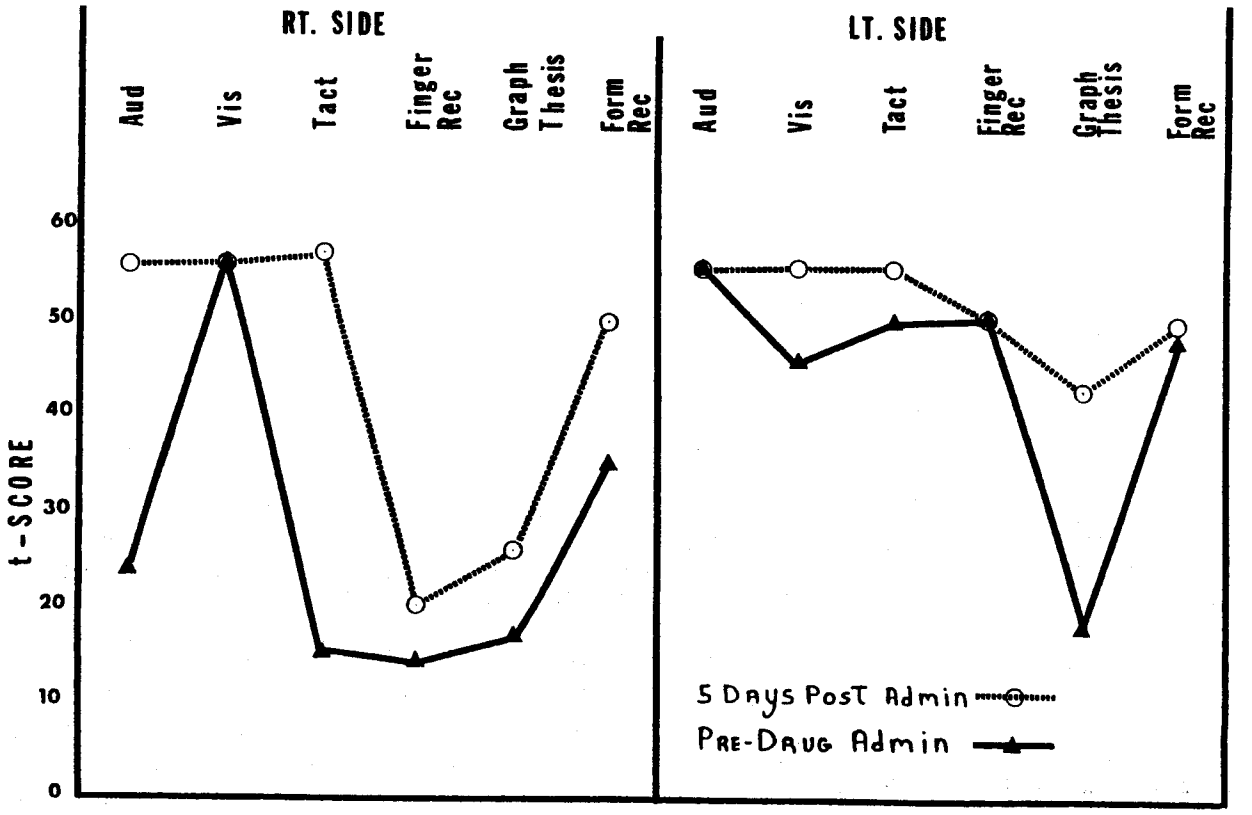

Figure 3. Summary of sensory performance tests for the right and left side of the body.

Speech and Language Tests. Table 1 shows the patient's mean overall communication skills and mean modality scores. Except for the Gestural Modality the patient improved at the fifth day and continued to improve at eleven days post medication.

Table 1. PICA modality and percentile scores.

	Overall %ile	Gestural %ile	Verbal %ile	Graphic %ile
Pre-Drug Administration	70	70	60	75
5 Days Post-Administration	75	65	85	80
11 Days Post-Administration	90	85	95	90

The Ranked Response Summary graphically demonstrates the patient's performance (Figure 4). Except for subtests II, III and F, the patient shows dramatic improvement on the more complex tasks, with little change on the less complex tasks, since there was little potential for improvement on those tasks.

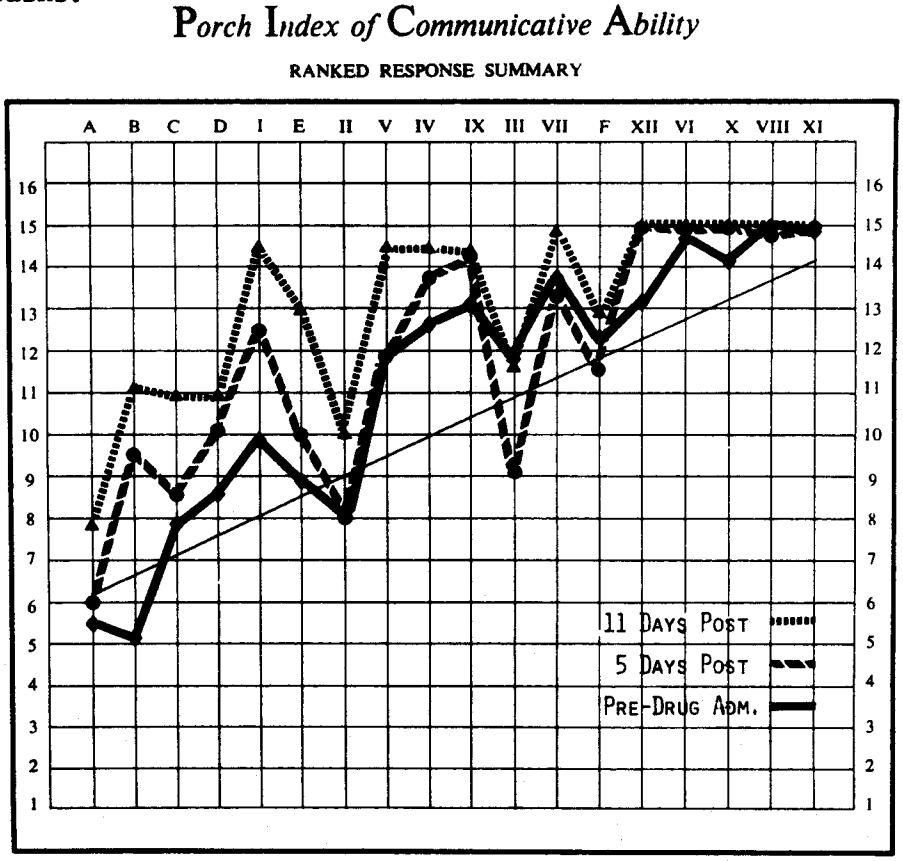

Figure 4. PICA subtest means for each test administration. The subtests are ranked from the most complex (left) to least complex (right).

According to Porch (1978) subtests II and III involve functioning of the high left parietal lobe, while subtest F involves the parieto-occipital lobe. The patient's depressed performance in subtest II, III, and F is consistent with the location of the tumors found by C.T. scan. Note the large area of involvement in the left parietal region and another smaller lesion in the right occipital area (Figure 5).

Figure 5. CT scan showing a contrast enhancing lesion with surrounding edema in the left parietal area and a non-enhancing lesion, mostly edema, in the right occipital area.

Based on these results the following hypotheses are offered:

a. As edema is reduced, along with intracranial pressure, there is a lessening of the global signs and thus a clearer delineation of the localizing effects of the lesions.

b. There is continuous improvement as edema is reduced.

c. Reduction of edema results in a general overall improvement across the speech and language skills tested by the PICA.

We would like to suggest that the study of edema in metastatic brain tumor patients has relevance to the study of spontaneous recovery of function in the stroke patient. Deciphering the effects of separate parameters during the spontaneous physiological recovery following stroke is difficult. It is necessary to separate out the effects of:

a. vasogenic edema and increased intracranial pressure (Fishman, 1975),

b. tissue damage (Fishman, 1975),

c. bilateral reduction of blood flow (Rubens, 1977),

d. increased presence of neurotransmitters in the blood stream (Rubens, 1977),

e. the effects of diaschesis (Rubens, 1977).

Patients with metastatic brain tumor share the following factors with stroke patients:

a. vasogenic edema and increased intracranial pressure,

b. tissue damage and tissue displacement.

Table 2. Potential physiological factors associated with recovery of function in metastatic tumor and cerebral vascular accidents.

Metastatic Tumor	CVA
1. Vasogenic edema and increased intracranial pressure	Present
2. Tissue displacement/damage	Present
3. Absent	Bilateral reduction of blood flow
4. Absent	Dumping of neurotransmitters
5. Absent	Diaschesis

SUMMARY

We are suggesting that one might be able to measure the effects on behavior of reducing edema and intracranial pressure by studying it in tumor patients like the one described in this paper. By gathering information on the nature, course and magnitude of improvement of function following the reduction of edema in metastic brain tumor patients, we may be able to better understand the effects of edema during spontaneous recovery following stroke.

Finally, our results indicate that the reduction of edema in cases of metastatic tumor produced definite, measurable effects on behavior. We propose that this relationship between the reduction of edema and behavioral changes presents clinicians with a model for studying and understanding the effects of spontaneous reduction of edema following stroke.

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