

Can Left-handed Writing Posture Predict Cerebral Language Laterality?

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• In terms of cerebral lateralization of function, left-handed persons represent a more heterogeneous group than right-handed persons. Some evidence suggests that left-handed subgroups can be identified on the basis of the following two types of writing posture: (1) inverted posture that indicates ipsilateral hemisphere language capability and (2) straight writing posture that indicates contralateral hemisphere language capability. A direct test of this hypothesis with an intracarotid amobarbital sodium injection failed to support these predictions. For clinical decisions in which the hemisphere subserving language is necessary, one should rely on direct assessment with the use of the amobarbital injection technique.

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The language ability of more than 90% of the right-handed population is subserved by the left hemisphere.^{1,2} However, the left-handed population is more heterogeneous, with respect to both the degree of manual preference³ and the relationship of cerebral dominance to language capacity.^{1,4} Thus, the fact that a patient is left-handed provides no clinical certainty about the lateralization of language function.

Results of recent behavioral studies have suggested that writing posture may be the most salient feature of handedness because it predicts which cerebral hemisphere subserves language.⁵ Specifically, a straight writing posture in which the hand lies below the line of writing is said to predict contralateral hemisphere language capacity, and a hooked writing posture in which the hand lies above the line of writing is said to predict ipsilateral hemisphere language capacity. Although the hooking posture is rare among right-handed persons, it is common with the left-handed population.⁶ If the claims regarding the predictive power of hand posture are

true, then hand posture could prove useful when a determination of the cerebral hemisphere that subserves language is needed, especially in left-handedness.

However, unlike the association between right-handedness and left-hemisphere language lateralization, which has been established on the basis of correlations between the incidence of aphasia among right-handed persons and the side of a unilateral cortical lesion, the claims regarding the neurologic significance of hand-writing posture have been advanced on the basis of behavioral studies of neurologically intact persons. Although the results of some behavioral tests have supported certain aspects of the claims about writing posture and hemispheric language lateralization, other evidence is not corroborative.⁷⁻¹¹

We report the results of tests with the use of amobarbital sodium injections that were carried out for diagnostic reasons, but these studies also allowed, for the first time, a direct test of the predictive value of writing posture. We also report the results of a dichotic-listening test designed to reflect language lateralization.

PATIENTS AND METHODS

Although the risks of cerebral angiography are generally low, the amobarbital injection procedure is performed only when planned neurosurgery may be modified by the identification of the hemisphere that subserves language function. The technique of amobarbital injection, 50 mg during a 10-s period, was faster than the graded injection described by Serafinides et al,¹² but less rapid than the standard procedure described by Wada and Rasmussen.¹³ The appropriate internal carotid artery was selectively catheterized under fluoroscopic control. After all amobarbital injections were done, diagnostic angiograms were taken. There were no complications.

The noninvasive behavioral assessment was an auditory double simultaneous stimulation test of speech-sound identification. Such dichotic speech-sound tests have been shown to reflect language lateralization in neurologically intact persons,¹⁴⁻¹⁵ patients with temporal lobe disease,¹⁶⁻¹⁹ and those patients who have undergone surgical section of the corpus callosum.^{20,21}

The four patients showed left-handed preference on a standardized handedness

and eyedness battery.²² Although complete family histories for patients 2 and 4 with regard to handedness were not available, no one was left handed in the family of patient 1. Patient 3 had had a left-handed brother. Hand posture was determined by having the patients sign their names. Although two patients had seizures as an initial symptom, all patients had been free of childhood medical and neurologic problems. In addition, all patients had bilaterally symmetric hearing thresholds within the normal range.

REPORT OF CASES

CASE 1.—A 27-year-old, left-handed woman had two episodes of right periorbital pain. She displayed the straight left-handed writing posture. Results of a neurologic examination were normal; however, further examination suggested a saccular aneurysm of the right intracavernous carotid artery. She became globally aphasic after an injection of amobarbital in the left carotid artery. After a complete recovery, a similar injection in the right carotid artery was associated with profound left hemiparesis, but there was no associated disturbance of language. She underwent successful clipping of her aneurysm and has remained asymptomatic.

CASE 2.—A 20-year-old left-handed woman had headaches and absence attacks. She displayed the straight left-handed writing posture. A neurologic examination did not disclose any abnormalities, but an EEG showed focal theta wave slowing in the right parieto-occipital area, and a computed tomographic (CT) scan showed a contrast-enhancing mass. Arteriography disclosed a right-sided posterior occipital arteriovenous malformation. Neuropsychologic examination showed global aphasia after an injection of amobarbital in the left carotid artery. The patient remained in full control of language functions after a similar injection into the right carotid artery. She underwent surgical excision of the lesion, with resolution of her symptoms.

CASE 3.—A 28-year-old left-handed woman had the onset of right-sided focal motor seizures and three grand mal convulsions. She displayed the straight left-handed writing posture. There was a mild right hemiparesis without aphasia. Although a CT scan was normal, an EEG showed focal slowing in the left parietotemporal area. Persistent right-sided hyperreflexia with an upward toe prompted an arteriogram. During arteriography, global aphasia appeared after an injection of amobarbital in the left carotid artery. The patient remained in full control of language function after a similar injection in the right carotid artery. The convulsive disorder was

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