Crossed Aphasia in a Dextral With Right Hemispheric Lesion: A Functional Transcranial Doppler Study

To the Editor:

I read with interest the article by Hund-Georgiadis et al.1 on crossed nonaphasia in a dextral with left hemisphere lesions published in the November 2001 issue of Stroke. They concluded from their data that different modalities such as language perception and production, attention, and motor performance are processed exclusively by one hemisphere when atypical cerebral dominance is present. They also suggested that the underlying functional organization of language remains rare and unclear in these cases. Our studies in normal subjects using functional transcranial Doppler (fTCD) suggest that this may not be rare after all. Left hemisphere lateralization for language was found in 61.5% of neurologically intact dextrals.3 Human pathology data obtained by Geschwind and Levitsky4 found that the planum temporale of the temporoparietal junction is larger in the left hemisphere in ~60% of the population.5 Furthermore, there was a high incidence of right-hemisphere lateralization for language in as much as 38.5% of neurologically intact dextrals.6 Dyslexics had a pattern that was opposite the normal pattern.7 Recently, the use of functional MRI and fTCD offers new approaches with more precise determinations of cerebral lateralization for language. To support the findings by Hund-Georgiadis et al and to provide new perspectives to the problem, I report here a single case study of a patient with a right-hemisphere lesion and aphasia in which fTCD was used.

A 56-year-old right-handed (100% on Edinburgh Handedness Inventory) man suffered from a left-sided sensory and motor deficit and global aphasia. The modified National Institutes of Health Stroke Scale score was 16 on admission. Eleven weeks later, the patient’s neurological deficits improved, with a modified National Institutes of Health Stroke Scale score of 3. CT scan revealed a hypodense lesion caused by cerebral infarct involving the prefrontal and temporoparietal territory of the right middle cerebral artery (Figure 1). Carotid color ultrasound imaging revealed that the infarctions were the result of embolism of a 79% stenotic lesion of the right internal carotid artery. Conventional TCD sonography studies showed generalized cerebral hypoperfusion. Cognitive testing was performed 6 weeks after symptom onset. The cognitive test battery included motor tasks (finger tapping), naming and word tasks, color processing, passive viewing of forms and shapes taken from the Raven’s progressive matrices, and viewing of faces. The fTCD involved the use of two 2-MHz probes placed within a head gear (LAM-Rack) of a bilateral simultaneous TCD (Multi-Dop T, DWL). Subject preparation, scanning, testing, and environmental controls were performed according to established protocol.2,4–6 Mean blood flow velocity at a depth of 50 mm in both middle cerebral arteries was monitored simultaneously at baseline and during cognitive testing. Laterality index was calculated as previously reported.2 Statistical analysis was performed by use of multivariate analysis of variance (Statistica, StatSoft). Mean blood flow velocity varied significantly in both arteries (vessel) during the cognitive tasks [F (1,17)=4205, P<0.00000001, MSe=1311]. There was cognitive test-by-vessel interaction [F (3,51)=5.2, P<0.003, MSe=4]. Figure 2 shows laterality index data for facial tasks, Raven’s task, and color processing; all were lateralized to the left hemisphere. In contrast, naming and word tasks were lateralized to the right. As expected, right finger motor task elicited left lateralization, whereas left finger motor task showed only a tendency toward right lateralization. Both fingers elicited a left lateralization.

The results showed that visuospatial tasks were lateralized to the left hemisphere and language tasks were lateralized to the right hemisphere. The finding that there was a preponderance of left-hemisphere activation for the examined visuospatial domain is consistent with the study by Hund-Georgiadis et al.1 The elicited reduced response to naming and word tasks in the pathological right hemisphere reflects the overall attenuation in language functional capacity as a result of the lesion. The left-hemisphere capacity to deal with visuospatial tasks underscores that mirrored organization can exist without obvious attenuation in functional capacity in the related domain. The findings by Hund-Georgiadis et al.1 and others7 using functional MRI adds a more discrete imaging localization to what has been established in gross anatomic dimensions using fTCD.2,4–6 However, fTCD expands the horizon for exploration of

Figure 1. CT scan showing a hypodense lesion resulting from cerebral infarct involving the prefrontal and temporoparietal territory of the right middle cerebral artery.

Figure 2. Lateralization pattern in both middle cerebral arteries during motor (top) and cognitive (bottom) tasks.
brain functional organization by physicians even in very remote areas of the world.

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**Response**

We would like to thank Dr Njemanze for the interesting comments on our article and for his profound presentation of a patient study on crossed aphasia: The anomalous lateralization of cognitive functions followed unilateral right hemisphere brain damage. The incidence of this type of anomalous language lateralization is unknown for numerous methodological reasons. Claims range from 1% to 13% of all aphasias.

Most certainly, the application of newer functional imaging techniques has contributed to a better understanding of hemispheric language dominance. Although functional MRI is characterized by its good spatial resolution, functional transcranial Doppler is marked by its wide applicability and availability. A direct global comparison of techniques in terms of laterality assessment may still be difficult and somewhat hampered by different task designs, stimulus modalities, and analysis procedures. Thus, given the results of more recent functional MRI laterality research, we are wondering whether the right hemisphere plays such an important role in terms of language dominance as pointed out by Dr Njemanze. In our sample, 94% of all right-handers showed a clear left-hemisphere dominance of language function. Exclusive right-hemisphere dominance was present in only 6% of healthy dextrals. Minor contributions from the right hemisphere occurred more frequently; however, their functional significance appears questionable. Regarding left-handers, only a very small portion of left-handed subjects (2%) shows exclusive right-hemisphere activation associated with language tasks. On the whole, left-handers are much better characterized by a left-hemisphere preponderance of language function (76%) or by a mixed laterality to different degrees.

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