

Dissociated crossed aphasia: A challenging language representation disorder

Abstract—A monolingual strongly right-handed woman developed a left hemiparesis and severe motor aphasia following a right middle cerebral artery infraction, whereas comprehension was entirely intact. She had a history of a transient cerebrovascular event characterized by right hemiparesis and fluent sensory aphasia. This case suggests a transhemispheric pattern of language organization in which the Broca area resides in the right hemisphere, whereas the Wernicke area is in the left.

NEUROLOGY 2002;59:441–442

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Aphasia is an acquired disorder of language and not merely of speech, and it occurs secondary to brain damage. As an exception to Broca's dogma, Bramwell¹ introduced in 1899 the concept of crossed aphasia to describe the occurrence of language disorders in patients who had undergone hemispheric lesions ipsilateral to the dominant hand. We report on a strongly right handed woman who, after experiencing a left hemisphere TIA characterized by right hemiparesis and jargon aphasia, developed a persistent left hemiparesis and severe motor aphasia with completely spared comprehension following a major right middle cerebral artery cerebrovascular event.

Case presentation. A 70-year-old woman was admitted to the hospital with abrupt onset of a left hand and foot weakness and severely disturbed speech. Bedside neurologic examination showed an alert patient with a severe left hemiparesis. There was severe reduction of spontaneous speech but with apparently normal comprehension; the only words that she could produce were "Yes" and "No," albeit with great hesitancy and difficulty. She had no gaze palsy or visual field defect. However, she could not recognize stimuli from the left side when they were applied simultaneously in half of the visual field, suggesting left visual inattention. Moreover, she appeared totally unaware of the functional defect of her left side. Tendon reflexes were increased on the left with a homolateral extensor plantar response and abolished left abdominal reflexes. She had a left central VII nerve paralysis. She also was unable to recognize the faces of familiar persons, but she could recognize them by their voices. Language comprehension was assessed by the Token Test² and the patient did not demonstrate even minor disturbances in the understanding of spoken speech, as she could manage successfully more and more complex instructions. Repetition and naming were severely impaired. She could not read aloud, but reading comprehension was entirely intact. In copying simple words with five or more letters, the patient made paralexical errors limited to the first part of the word and only the last one or two letters were the correct ones

(although dysmorphic), suggesting left neglect. Additionally, writing single dictated words was not possible. She could use the objects in her environment correctly, and also she was able to demonstrate the use of objects that were shown to her. Neurologic examination of the right half was entirely normal. The patient had a medical history of hypertension, hyperlipidemia, and atrial fibrillation.

One year previously, she had suddenly developed a right hemiparesis with a simultaneous language disorder characterized by abundant jargon with neologistic and phonemic paraphasias; spontaneous speech was fluent with preserved intonation, and auditory comprehension was heavily impaired. At that time, she could not answer properly to "yes"/"no" simple questions or point to objects and follow simple spoken commands. When reading short sentences aloud she made many paralexical errors; comprehension of written language was impossible; and repetition and writing to dictation were severely affected. Then, she was admitted to the hospital with a diagnosis of Wernicke aphasia due to a lesion of the left hemisphere, but the event was completely resolved 3 hours after onset. In that first incident, CT was normal and EKG confirmed atrial fibrillation.

Interviews of family members stated that all her activities on the Edinburgh Handedness Inventory³ were performed with the right hand. She had no childhood brain damage. Also, her relatives confirmed that the patient was speaking only Greek and there was no history of sinistrality or ambidexterity in her family. CT scanning (figure) performed 7 days after admission revealed a hypodense lesion involving cortical and subcortical areas proximal and peripheral to the right middle cerebral artery territory, including the lentiform nucleus and internal capsule. There was no radiologic evidence of lesion in the left hemisphere. Fifteen days after admission she continued to have severe articulatory impairment. She could spell some simple words, but her speech was slow and laborious with abnormal prosody. She needed much effort to pronounce consonants rather than vowels, but she was unable to spell clusters of consonants. Repetition, reading aloud, writing, and naming were still severely impaired.

Discussion. Aphasia in a right-handed person following a right hemisphere lesion is not common (1 to 2% of all patients with aphasia). Several theories have been proposed to clarify the mechanisms that underlie this phenomenon. Most cases seem to be compatible with the mirror image hypothesis^{4,5} whereby the syndrome resulting from a right hemi-

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Received September 24, 2001. Accepted in final form April 2, 2002.

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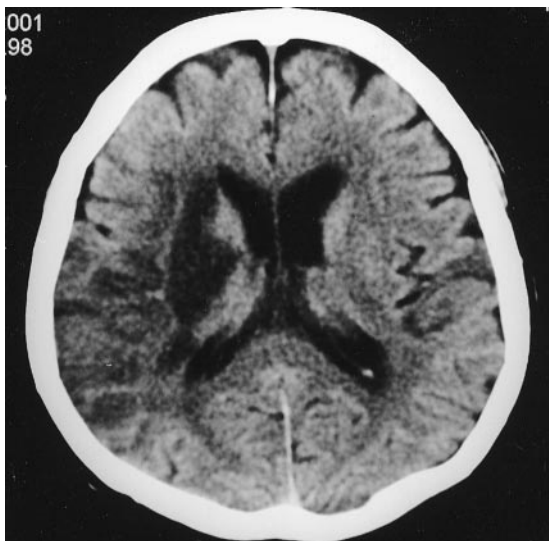


Figure. CT scan shows a 7-day-old infarct proximal and peripheral to the right middle cerebral artery territory. Well-defined hypodensity involves cortex, underlying white matter, and the basal ganglia region on the right.

spheric lesion mirrors what would have happened if the lesion had been on the left hemisphere.⁶ Other proposed explanations include incomplete or independent lateralization,⁷ whereas Annett's⁸ right shift theory of handedness may account for cases of anomalous dominance.

Our patient has a distinct profile of language lateralization in that production and comprehension are restricted to different hemispheres, whereas gnostic and practic processes appeared to be organized in a normal fashion. The second event produced a large right middle cerebral artery stroke, leading to a Broca instead of a global aphasia. This interpretation argues against the view that because the patient had atrial fibrillation she could have had two emboli causing the first episode, one to the left hemisphere causing the right hemiparesis and a second to the right hemisphere causing the Wernicke aphasia. Moreover, the ischemic infraction in the second episode involves the right auditory association cortex (Brodmann area 22) and the surrounding temporoparietal cortex, suggesting that this area is not essential for language comprehension.

The neural pathway that connects auditory association cortex (Wernicke area) and articulatory motor cortex (Broca area) normally is localized in the left hemisphere in right handers and language functions are considered to be strongly left lateralized, although bihemispheric activation was observed in

functional neuroimaging techniques such as PET and fMRI.⁹ The fact that our patient had a complete loss of productive language capacity and repetition after a massive right hemisphere stroke suggests that her phonologic sequence knowledge resided in the right hemisphere. However, the prior episode of impaired language perception in association with the left hemisphere event indicates that phonology from heard words was translated to semantics in the left hemisphere and, thus, the acoustic-semantic network resided in the left hemisphere. The patient presented here suggests a transhemispheric representation of phonologic sequence knowledge because she had a single acoustic-articulatory motor pattern associator with the proximal acoustic pole resided in the left hemisphere and the distal articulatory pole in the right hemisphere. The patient had intact auditory and reading comprehension because acoustic-semantic processing and orthographic-semantic processing in the left hemisphere were completely spared. In contrast, she could not read aloud because reading aloud requires a pattern associator linking orthographic with articulatory motor representations, and in our patient the integrity of the articulatory motor system was severely damaged by the right hemisphere stroke.¹⁰

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Neurology 2002;59;441-442

DOI 10.1212/WNL.59.3.441

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