

Crossed Aphasia: Analysis of Four Cases

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Four right-handed patients with unilateral vascular right-hemisphere lesions, confirmed by clinical and (in three cases) by neuroradiological data, displayed aphasic syndromes similar in several respects to those classically seen following left-hemisphere lesions with the exception of their writing behavior. Language profiles resembled Broca's aphasia (two cases), transcortical sensory aphasia (one case), and global aphasia (one case). Two patients also showed visuo-spatial impairment. One patient recovered but in the other three, aphasia remained severe throughout the follow-up period (9 to 20 months). It is suggested that the prognosis and course of recovery in patients with crossed aphasia may in some cases be more related to the location and severity of the cerebral lesion than to the side of hemispheric involvement. In those cases the language disorder follows a pattern comparable to that seen after left-hemisphere lesions in right-handed patients.

Crossed aphasia consists of the occurrence of aphasia in a right-handed individual following a lesion of the right hemisphere (Bramwell, 1899). Even though several cases of crossed aphasia have been reported in detail, there is a lack of agreement about its incidence, its neurolinguistic characteristics, its accompanying neuropsychological deficits, and its prognosis.

Estimates of its incidence range from 0.4% (Hécaen, Mazars, Ramier, Goldblum, & Merienne, 1971) to 10% (Branch, Milner, & Rasmussen, 1964). A recent review has stated that the primary characteristics of crossed aphasia are agrammatism, good or moderately impaired com-

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prehension, no apraxia, and no visuo-spatial deficits (Brown & Wilson, 1973) but others have described cases that do not fit that description (e.g., Marinesco, Grigoresco, & Axente, 1938). Crossed aphasia has often been said to be mild in severity and transient in nature (Zangwill, 1967; Brown & Wilson, 1973; Brown & Hécaen, 1976). Other authors (Lozano & Clark, 1976; Wechsler, 1976; April & Tse, 1977), however, have found the deficits to be permanent. These discrepancies are in part related to the fact that confounding variables (age, etiology, lesion size and location, educational background of the patients, and previous medical, neurological, and linguistic history) have not always been adequately controlled.

Until recently, diagnosis of crossed aphasia was difficult because the existence of a concomitant lesion of the left hemisphere could be ruled out only at autopsy. With the advent of new neuroradiological technology, the ability to localize cerebral pathology has improved. Several authors (Lozano & Clark, 1976; Wechsler, 1976; Petit, McNeil, & Solomon, 1978; April & Tse, 1977; Brown & Wilson, 1973) have illustrated that computerized tomography (CT scan) and radioisotope brain scans are useful in the early diagnosis of crossed aphasia.

In this paper we describe four cases of crossed aphasia, three of which were confirmed by neuroradiological techniques. Neurolinguistic analysis showed that, with the exception of their writing performance, these patients had a clinical picture which corresponds closely to that seen in right-handed individuals after left-hemispheric lesions.

Neurolinguistic abilities were assessed by the *Boston Diagnostic Aphasia Examination* (BDAE, Goodglass & Kaplan, 1972) or the *Minnesota Test for the Differential Diagnosis of Aphasia* (MTDDA, Schuell, 1965). Standardized nonverbal testing including Wechsler Adult Intelligence Scale (Performance Subtest) Bender-Gestalt Visual Motor Test, Hooper Visual Organization Test, Goodenough Draw-a-Man Test, Porteus Maze, Wisconsin Card Sorting Test, the Rey Figure, and the Seashore Test of Musical Ability (Rhythm test) was completed on two patients. Handedness of the patients and of their immediate families was assessed by the Edinburgh Inventory (Oldfield, 1971).

CASE REPORTS

Case I

A 50-year-old right-handed male with an eighth grade education experienced sudden onset of nonfluent aphasia and mild left upper extremity weakness on May 17, 1974, and was admitted to the Cleveland VA Hospital. Radioisotope brain scan (Fig. 1) performed 4 days later demonstrated an area of increased uptake in the right fronto-parietal area consistent with an infarct.

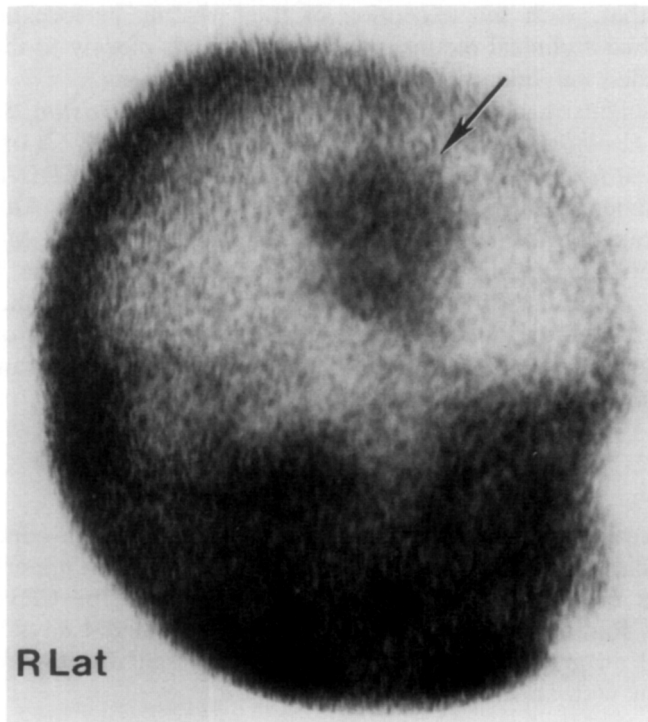
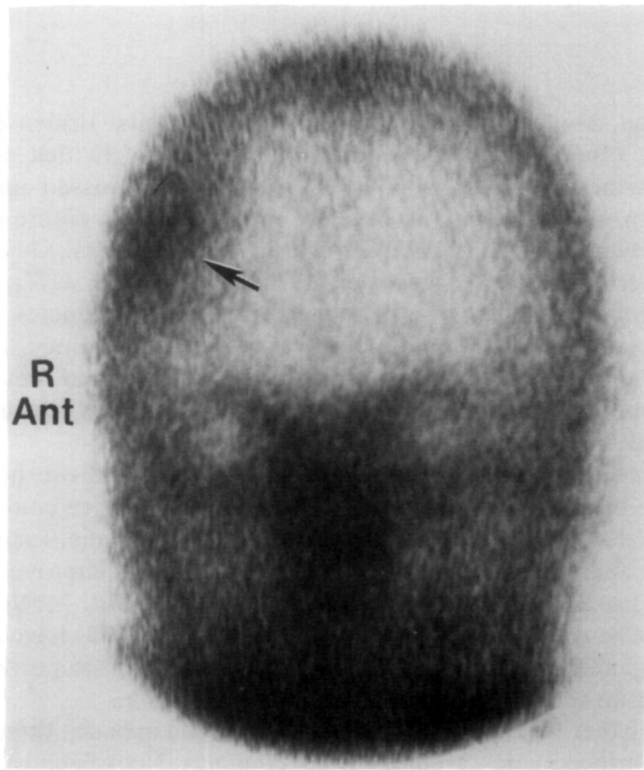


FIG. 1. Case I. Radioisotope brain scan. In both the lateral and anterior views, a peripheral area of increased uptake can be seen in the right fronto-parietal area, consistent with a focal area of cerebral infarction.

Assessment of the patient's speech and language skills suggested a moderately severe Broca's aphasia. The patient's spontaneous speech was characterized by awkward articulation, reduced vocabulary and agrammatism. Writing showed greater syntactic differentiation than verbal output and some neologisms.

Receptively, the patient displayed minimal difficulty in auditory comprehension for general conversation and simple commands. His reading comprehension was moderately impaired at the word and sentence level.

Further neuropsychological testing showed adequate performance on conceptualization, right-left orientation, and color-naming tasks. However, he displayed marked visuo-spatial deficits, both in planning and organization, even with simple perceptual discrimination tasks. He had an impairment of left-hand stereognosis, auditory rhythm patterns, visuo-constructive tasks, and drawing (both copying designs and spontaneous drawing). In the above tasks, his results were judged to be comparable to those usually seen in patients with fairly extensive lesions of the "nondominant" hemisphere.

The patient was discharged 10 days after admission by which time there had been a marked improvement of his aphasia. He was not seen again until September, 1975, when he presented to the emergency room of the Cleveland VA Hospital because he had experienced paresthesia and weakness of his right upper limb. The patient stated that during the episode, which lasted about 20 minutes, he had not experienced a disorder of speech or language. Neurological examination showed no significant abnormality: he had good strength and normal reflexes bilaterally and he was not aphasic. A tentative diagnosis of transient ischemic attack was made and he was advised to remain at the hospital but the patient refused admission and has since been lost for follow-up.

Case II

A 61-year-old right-handed male with a high school education was admitted on June 6, 1978, to the Cleveland Metropolitan General Hospital because of sudden onset of aphasia, left facial weakness, left hemianopsia, and left hemiplegia. A CT scan (Fig. 2) performed on June 7, 1978, revealed a large area of increased density in the right fronto-temporal area and a shift of midline structures to the left, suggesting an intracerebral hematoma with associated intraventricular hemorrhage. The hematoma was evacuated the same day. The operation was uncomplicated and a postoperative CT scan showed that the midline shift was no longer present. There was, however, no improvement in the patient's neurological status and he was transferred to Highland View Hospital for further rehabilitation on June 26, 1978.

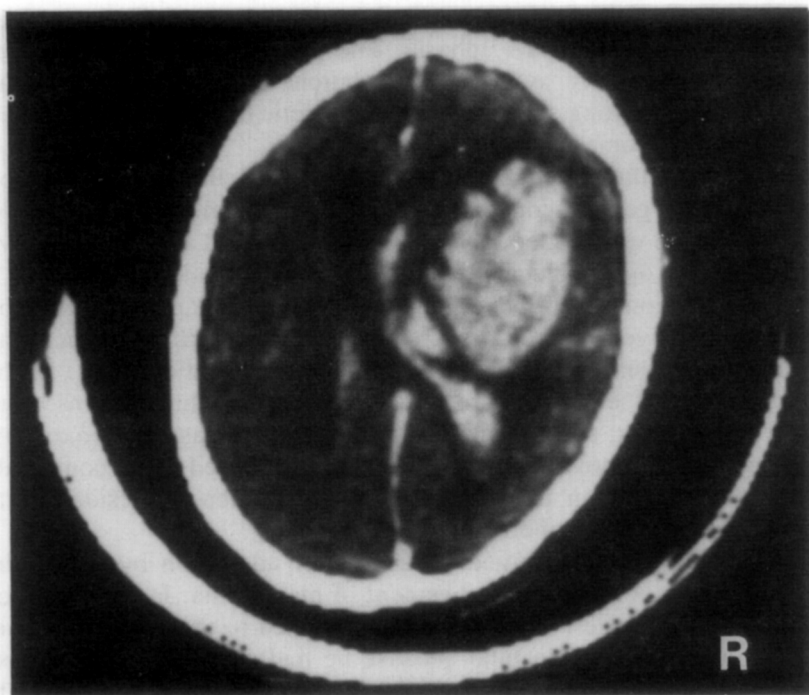


FIG. 2. Case II. CT scan. A broad area of acute hemorrhagic infarction is present in the deep right fronto-temporal region causing medial effacement of the right lateral ventricle and slight displacement of the third ventricle to the left of the midline. The area of hemorrhage involves the caudate nucleus, putamen, globus pallidus, thalamus, and internal capsule. Also note intraventricular hemorrhage.

On June 23, 1978, assessment of his speech and language skills (BDAE) indicated global aphasia. Limited communication was possible; the patient's speech was hesitant and limited to a few automatic phrases and stereotypes. Literal and verbal paraphasias were present on naming and repetition tasks. This patient's writing skills were superior to his verbal skills with near-normal performance on copying tasks. Spontaneous writing consisted of unrelated words representing all lexical classes and letters. His auditory comprehension was severely limited. He performed better with visual stimuli, as he recognized common words and retained some word-attack skills relatively well.

Visuo-spatial tasks, such as copying of geometric designs, block construction and object assembly showed evidence of moderate-to-severe visual constructive impairment. His constructional performance was, however, superior to his performance on most language tasks. Planning and organization were severely impaired even when language was not

a critical contributor to task performance. Nonverbal auditory skills were not evaluated.

The patient was transferred to a long-term care unit on September 15, 1978. When last seen (February 19, 1980), there had been very little change in his spoken language but his ability to write as well as his reading comprehension had improved.

Case III

An 80-year-old, right-handed, high-school-educated male was transferred to Highland View Hospital on July 11, 1978. On June 13, 1978, he had experienced sudden aphasia, left facial weakness and left hemiplegia and had been admitted to Cleveland Metropolitan General Hospital. There was no previous history of stroke or other CNS disease. A CT scan (Fig. 3) performed on July 31, 1978, revealed a large mass in the depth of the right centrum semiovale; its margin was clearly enhanced by contrast medium. There was a slight displacement of the ventricular system to the left. This picture was felt to be compatible with a hemorrhagic infarction.

Initially, formal testing was difficult due to the patient's severe comprehension deficit. He showed evidence of left hemi-inattention. His verbal output consisted almost entirely of echolalia. He compulsively repeated all verbal stimuli directed toward him, maintaining the stress and intonation patterns of the model with no evidence of auditory comprehension, a picture resembling the isolation of the speech area syndrome (Geschwind, Quadfasel, & Segarra, 1968). Some communication became possible 6 to 8 weeks later as the patient's deficit evolved into transcortical sensory aphasia. Limited spontaneous speech was present. It consisted of extended English jargon, i.e., running speech composed of English words in a meaningless sequence. The patient used negations and occasional verb transformations. His word choice was inappropriate, with the use of unusual paraphasias; for example, when once asked, "How are you?" he answered, "Jew of salvation." On another occasion, he named the picture of a cactus as "wine and women." Literal, verbal, and neologistic paraphasias were prominent on repetition and naming tasks, and less apparent in spontaneous speech. Over time, the frequency of echolalia declined with an increase in automatic responses and extended English jargon.

When given paper and pencil, the patient handled them correctly but spontaneously would only produce strings of unrelated words. He never wrote full sentences. He was unable to write to dictation or to copy letters, words, and figures.

Auditory comprehension remained poor in this patient, although he responded more appropriately in conversation than in an instructive setting. He remained severely alexic, but was able occasionally to identify letters, numbers, and words correctly.

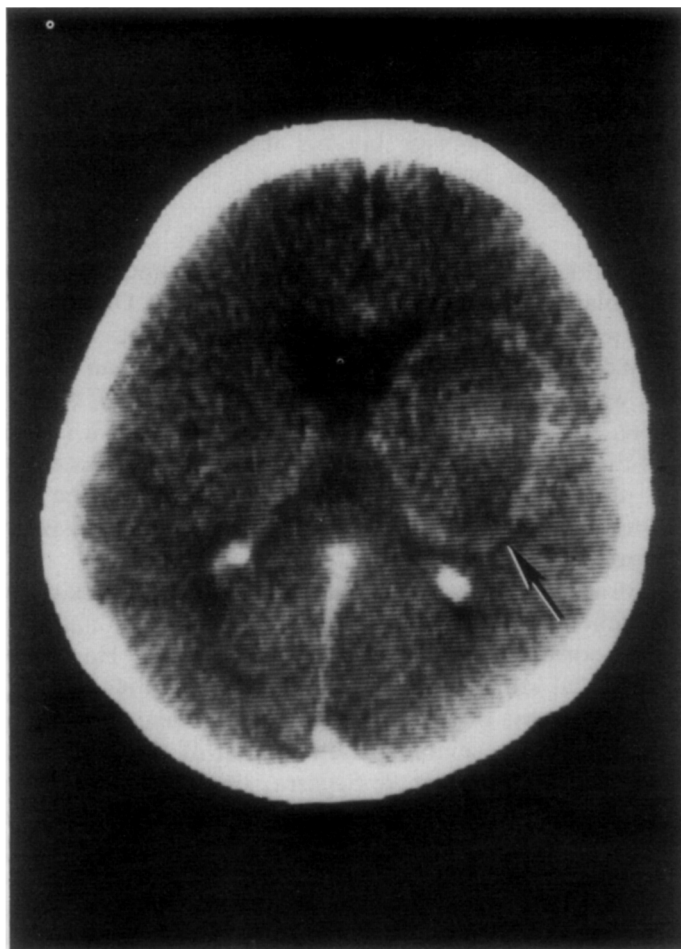


FIG. 3. Case III. CT scan. Note broad area of resolving hemorrhagic infarction deep in the right temporal area with involvement of the internal capsule, thalamus, caudate nucleus, and putamen on that side.

Because of the patient's limited comprehension, further neuropsychological testing was not possible. Repeated CT scan performed on August 28, 1978, showed a large, poorly demarcated area of decreased density in right basal ganglia and right temporo-parietal lobe. There was no shift of midline structures.

When last seen (February 19, 1980) his aphasia had remained essentially unchanged. He understood only simple one-step commands and his spontaneous language consisted of English jargon with a large amount of echolalia.

Case IV

A 50-year-old, right-handed, female with a high school education was admitted to the Cleveland Metropolitan General Hospital on May 16, 1978, following sudden onset of aphasia, mild dysarthria, left homonymous hemianopsia, left central facial weakness, and left hemiplegia. CT scan was uninterpretable due to motion artifact. Following transfer to Highland View Hospital on June 26, 1978, assessment of the patient's speech and language skills showed a fairly typical Broca's aphasia involving all modalities, with expressive language more severely involved than receptive language. Spontaneous speech was telegraphic and agrammatic, with decreased melodic line, visible effort in articulation and hesitations. A severe phonological defect was evident in conjunction with a mild dysarthria, resulting in the simplification of phonemes, vowel distortions, omissions of final consonants, and sound substitutions. Grammatical structures included noun and verb combinations and verb phrases. Naming and repetition were mildly affected due to reduced articulatory agility. The patient's writing was restricted to simple grammatical forms with reduced vocabulary. However, her graphic output was not as severely affected as her verbal output. Her auditory comprehension for simple commands and general conversation was within normal limits.

Further neuropsychological assessment was not performed. A left-sided hemi-inattention and hemianopsia were observed during hospitalization. The patient was last seen in February, 1979, at which time she was unchanged. She has since been lost for follow-up.

DISCUSSION

These four right-handed patients displayed aphasia following unilateral vascular right-hemisphere lesions. Classic aphasic syndromes, comparable to those seen with left-hemisphere lesions, were identified in all subjects. Visuo-spatial deficits were present in varying degrees in two of the four cases. There was no evidence of previous neurological or linguistic deficit nor prominent history of familial sinistrality in any of the cases.

This study does not allow us to draw firm conclusions about the incidence of crossed aphasia but it may be interesting to note that during the year in which Cases II, III, and IV were evaluated (1978), 101 patients were seen in ongoing aphasia therapy at Highland View Hospital.

In their review of general trends in the crossed-aphasic population, Brown and Wilson (1973) found expressive deficits to be more prominent than receptive ones. Agrammatism, mildly impaired repetition and naming, the absence of apraxia, and mild-to-moderately-impaired auditory comprehension and writing were better than auditory comprehension and speech. Verbal paraphasia and severe auditory comprehension appeared occasionally.

In our study, the linguistic characteristics of two patients (Case I, Case IV) were similar to those reported by Brown and Wilson (1973). Both our patients had nonfluent Broca's aphasia and both displayed primarily expressive rather than receptive deficits. Writing was better than speech in each instance. Reading and auditory comprehension performances did not differ significantly.

The linguistic profile of Case II differed from the classical description of crossed aphasia, and it changed over time. This patient initially displayed a severe language deficit best described as global aphasia. Interestingly, this patient's reading comprehension and writing later improved significantly and became superior to auditory comprehension and speech, a change closely corresponding to a trend described by Brown and Wilson (1973).

The patient in Case III demonstrated a relatively uncommon aphasic syndrome. An initial transcortical aphasia (isolation of the speech area syndrome) evolved within 2 months from the initial insult into a transcortical sensory aphasia. The linguistic performance of this patient differed significantly from previous descriptions of crossed aphasia. Repetition was near normal, receptive deficits were more severe than expressive deficits, and both auditory comprehension and verbal expression were superior to reading comprehension and writing. This patient was considerably older than the other three cases, a fact which may be relevant in view of the observation (Obler, Albert, Goodglass, & Benson, 1978) that the incidence of fluent aphasia tends to increase steadily with age.

In order to determine whether the linguistic deficits demonstrated by crossed aphasics were similar to those seen in the left-hemisphere damaged population, the BDAE profiles of three of the four patients in the present study were compared to the range profile scores identified for various classic syndromes (two Broca's aphasias, and a transcortical sensory aphasia). The profiles are based on the initial evaluation except in Case III where it is based on evaluation 2 months after his stroke (Fig. 4). Our patients' profiles fell within the projected range for each syndrome with the exception of greater "articulatory agility" in Case I. Figure 4 also shows the language scores of Case II even though the BDAE does not provide a standard profile for global aphasia.

To date, there have been few well-documented case studies of crossed aphasia. The most often quoted cases include those of Marinesco et al. (1938); Ettlinger, Jackson, and Zangwill (1955); Botez and Wertheim (1959); Angelergues, Hécaen, Djindjian, and Jarrie-Hazan (1962); Barraquer-Bordas, Mendilaharsu, Peres-Serra, Acevedo de Mendilaharsu, and Grau-Veciana (1963); Clarke and Zangwill (1965); Hécaen et al. (1971); Brown and Wilson (1973); Lozano and Clark (1976); Wechsler (1976); April and Tse (1977). A review of these case studies reveals a

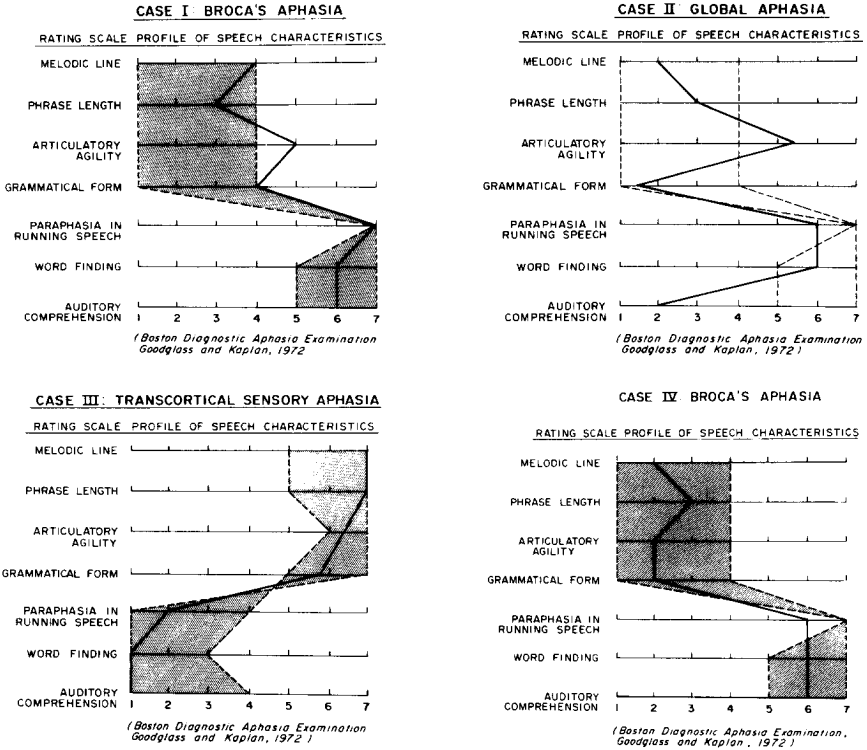


FIG. 4. Rating scale profile of the speech characteristics of our four cases. The profile for each case is plotted with a solid black line. For Cases I, III, and IV, the gray area shows range of ratings (Goodglass & Kaplan, 1972) characteristic of the various aphasia syndromes. The interval between the stroke and the language examination on which these profiles are based was 1 week (Case I), 23 days (Case II), 11 weeks (Case III), and 6 weeks (Case IV).

predominance of nonfluent aphasia (72%, including Broca's and global), with fluent aphasia occurring less frequently (27%). These percentages correspond fairly closely to those found in the left-hemisphere-dominant population (Kertesz, 1979; Vignolo, 1973).

Most types of classic aphasia syndromes have been identified in the crossed-aphasia population. Hécaen et al. (1971) described a case of global aphasia which resulted from a right-hemisphere lesion and later evolved into conduction aphasia. Another case of conduction aphasia was described by Lozano and Clark (1976). Fluent aphasia, such as Wernicke's (Marinesco et al., 1938) and pure word deafness (Ettlinger et al., 1955) as well as numerous cases of Broca's aphasia (Botez & Wertheim, 1959; Brown & Wilson, 1975; Wechsler, 1976; April & Tse, 1977) have also been described in the literature. One of our patients

(Case III) appears, however, to be the first reported instance of crossed transcortical aphasia.

Despite the fact that specific types of aphasias have been identified, Brown and Wilson (1973), in their review of this literature, described only the most common linguistic characteristics shared by all these cases. The present study shows that several aphasic syndromes similar to those seen in dominant left-hemisphere-damaged patients, can be clearly identified in the crossed-aphasia population. Perhaps, a more effective approach to studying crossed aphasia would be to identify specific types of aphasias and compare left-hemisphere-damaged aphasics with this population.

The most frequently reported cause of crossed aphasia to date has been trauma (56.5%—Boller, 1973) followed by vascular etiology (23%), tumors and abscesses (19%), and surgical procedures (1.5%). As pointed out by Boller (1973), the validity of reported cases of crossed aphasia resulting from tumor and trauma is questionable since bilateral damage and distant effects are frequent. In our opinion, firm conclusions about the characteristics of crossed aphasia are best reached by including only cases of unilateral vascular lesions. As shown in Fig. 2 and 3, the vascular lesion of Case II and to a lesser extent that of Case III produced some shift of the midline, thus acting like space-occupying lesions. One must recall, however, that the CT scan of Case II was performed the day after the stroke and before neurosurgery. In the course of the operation, the hematoma was evacuated and intracranial pressure was therefore in all likelihood brought back to normal. A postoperative scan no longer showed a midline shift. In Case III the shift was mild and had disappeared 4 weeks later. We therefore have every reason to believe that even in these two cases, the aphasia and other neurological deficits reflected only right-hemisphere pathology.

Several reported cases of crossed aphasia have been found to have good recovery rates. In these cases it is often postulated that bilateral dominance for language produces a mild transient aphasia, since the uninjured hemisphere is able to assume control of language function (see Brown & Hécaen, 1976). The concept of incomplete language lateralization is also suggested by cases reported by Botez and Wertheim (1959), Angelergues et al. (1962), and Kinsbourne (1971).

In contrast to the above view of crossed aphasia as a transient state, many authors have described crossed aphasias with persistent linguistic deficits. Several authors have reported a period of rapid improvement one to two months postonset, with little recovery thereafter (Ettliger et al., 1955; Hécaen et al., 1971; Lozano & Clark, 1976; Wechsler, 1976; April & Tse, 1977). One patient reported by Marinesco et al. (1938) presented a stable linguistic profile with no significant improvement occurring until many months postonset.

In our study, all but one of the four patients remained clearly aphasic. Three patients showed a short period of rapid improvement with a plateauing of linguistic performance a few months postonset. Case II, similar to the one reported by Marinesco et al., showed no significant recovery until 10 months postonset as far as his spoken language is concerned.

It is interesting that among our patients, the only one whose aphasia improved markedly (Case I) apparently did not develop an obvious language disorder during a presumed transient ischemic attack that affected his left hemisphere. These observations suggest that not all cases of crossed aphasia have bilateral language representation.

The literature on crossed aphasia to date has focused on the linguistic characteristics of crossed aphasia, with little reference to concomitant visuo-spatial deficits. Those studies which have addressed this issue report varying visuo-spatial abilities among their cases; e.g., unilateral neglect (Hécaen et al., 1971), impaired visuo-constructive and visual retention abilities (April & Tse, 1977), and constructional and dressing apraxia (Lozano & Clark, 1976). In our study, two patients who could be tested (Cases I and II) displayed severely impaired performance on most nonverbal and perceptual motor tasks. This visuo-spatial deficit closely resembled that usually found in lesions of the nondominant hemisphere. The other two patients showed inattention to the left visual field.

Individual variation is to be expected among crossed aphasics as it is in the normal population. Kreindler et al. (1966) hypothesized that visuo-spatial, motor and language functions lateralize independently of one another to either hemisphere. Therefore, the lateralization of one cerebral function does not necessarily determine the lateralization of another. The discrepancies in the literature concerning visuo-spatial abilities among crossed aphasics may be merely the result of the process of chance distribution of cerebral dominances.

The present paper and other recent reports (e.g., Petit et al., 1978) show that in some cases crossed aphasia is in many respects similar to the aphasia usually seen following left-hemisphere lesions in right-handed subjects. Cross-matched studies of crossed aphasias and classic aphasias should, in the future, establish the frequency of this phenomenon.

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