Panel: Unusual Aphasias: Crossed Aphasia

Nina F. Dronkers
Veterans Administration Medical Center, Martinez, California

The term "crossed aphasia" has undergone an important change in meaning over the last century. When it was first introduced by Bramwell in 1899, "crossed aphasia" referred either to left-handed aphasic patients with left cerebral hemisphere damage or to right-handers with right hemisphere damage. These days, the term describes only right-handers who develop aphasia following a lesion in the right hemisphere -- aphasia which cannot be explained by familial history of left-handedness or childhood central nervous system impairment.

The occurrence of these cases is rather rare. Hecaen and colleagues (Hecaen, Mazurs, Ramier, Goldblum and Merienne, 1971) estimated the incidence to be about .38%, Gloning, Gloning, Haub and Quatember (1969) and Benson and Geschwind (1972) thought it to be around 1%, while Zangwill (1967) arrived at a 1.8% figure. Brown and Hecaen (1976), in their review of the literature on crossed aphasia, concluded that in only nine cases could absence of familial sinistrality and previous neurologic involvement be determined with confidence. Later, Haaland and Miranda (1982) raised this number to 15 cases. Boller (1973), Han and Foo (1983) and others have presented a different sort of evidence for the existence of crossed aphasia with cases of damage to language areas in the left side of the brain without evidence of language deficit. Further support for the ability of the right hemisphere to assume linguistic functioning are the reports of aphasia following right hemisphere damage in left-handers (Delis, Knight and Simpson, 1983; Naeser and Borod, 1986).

Some (e.g., Zangwill, 1967) have suggested that the language disorders seen in cases of crossed aphasia might differ from those seen in left-hemisphere-damaged aphasic patients. Brown and Wilson (1973) have shown that agrammatism and agraphia are frequent symptoms in crossed aphasia regardless of lesion site, and that comprehension, verbal expression and naming are typically the least impaired. Deficits in attention and arousal, memory or visual-spatial processing may also be evident.

In light of the suggestion that crossed aphasia may produce an unusual language profile, we decided to undertake a systematic comparison of the residual language of aphasic patients with right and left hemisphere lesions. Specifically, we compared the language deficits of right-handed aphasic patients with left hemisphere lesions with the language deficits of two right-handed aphasic patients with right hemisphere lesions (crossed aphasia) and one left-handed aphasic patient who also sustained a right hemisphere lesion.

CASE HISTORIES

The first of our right hemisphere patients, J.C., was a 50-year-old right-handed male, who suffered a right hemisphere anterior cerebral artery aneurysm which bled and was subsequently clipped. He displayed severe and persistent Broca's aphasia by the Boston Diagnostic Aphasia Examination criteria. A.M., a 61-year-old right-handed female, suffered a right hemisphere middle cerebral artery thromboembolic infarct. She initially displayed severe Broca's aphasia that soon evolved to transcortical motor aphasia,

though her lesion was predominantly subcortical. F.D., a 67-year-old left-handed male, also suffered a right hemisphere middle cerebral artery thromboembolic infarct. He displayed severe and persistent Wernicke's aphasia. None of the three patients had a family history of left-handedness, nor any history of prior CNS involvement.

METHOD

All three patients received complete neurologic, radiographic and language evaluations. In the effort to match these patients with left-hemisphere-damaged aphasic patients, we culled our clinical files to select right-handers who had sustained single left hemisphere lesions, had undergone speech and language evaluation at the same time post-onset as our right hemisphere patients, demonstrated similar types of aphasia, and whose lesions compared in terms of size and intrahemispheric location. Three patients were found to match J.C., our Broca's crossed aphasia patient; two to match F.D., our left-handed Wernicke's patient with the right hemisphere lesion; and one to match A.M., our subcortical crossed aphasic patient.

Our next task was to compare the patients on the subtests of the Porch Index of Communicative Ability (PICA; Porch, 1967). This particular test was chosen because of its highly structured, standardized format covering most aspects and modalities of language. It was also the one most consistently administered to all three patients and allowed for the best comparisons. Our results of patient comparisons on these subtests will be discussed within each of the patient groups.

RESULTS

Figure 1 displays the data on the reading subtests for the patients with Broca's aphasia. These tests require the patient to read a small card and carry out the instructions printed there. An example of an item of Subtest V requires the patient to read and perform "Put this card to the right of the one used for cleaning teeth." Subtest VII calls on the name of the object rather than its function -- "Put this card to the right of the toothbrush." The performance of patients with left hemisphere damage is shown by the dotted bars, while that of J.C., the right hemisphere damaged patient, is depicted by the solid bars. As you can see, there is little difference in performance between our crossed aphasic patient and two of the left hemisphere patients on these reading measures. Patient G.E. has more difficulty reading than both his left hemisphere cohorts and J.C., the crossed aphasic patient.

A striking difference was seen, however, on the writing subtests. The instructions for the writing subtests are as follows: Subtest A: "In complete sentences, write here what you do with each of these." Subtest B: "Write here the name of each of these." Subtest C: "Write here the name of each one after I say it." Subtest D: "Write each name here after I spell it." J.C. performed substantially better than the other three patients (Figure 2). When we examine the written samples from these patients, we see where these differences arise. Figure 3 shows an example from the left hemisphere group on Subtest A and the sample by J.C., demonstrating a remarkably preserved ability for written expression by this crossed aphasic patient. Syntactic and spelling errors are evident in J.C.'s performance, but his expressive skills are clearly far superior. In the writing to dictation task, Subtest C (Figure 4), the difference between J.C.'s performance and one of the left hemisphere patients is also apparent.

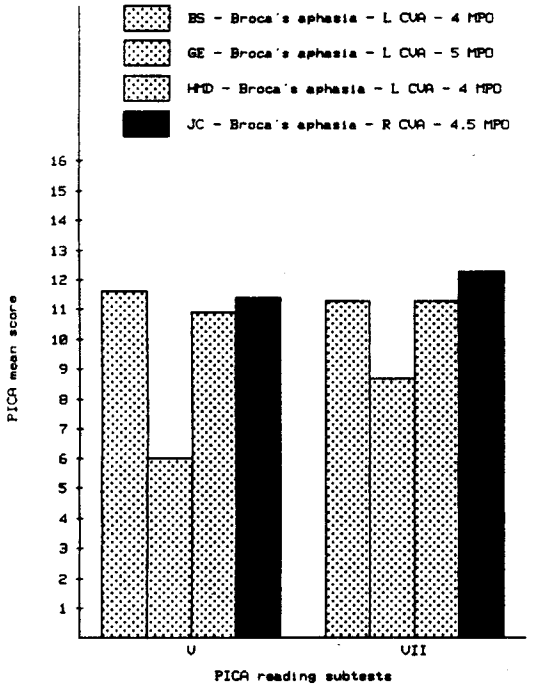


Figure 1. PICA reading subtest data for Patient J.C. and three left-hemisphere cohorts.

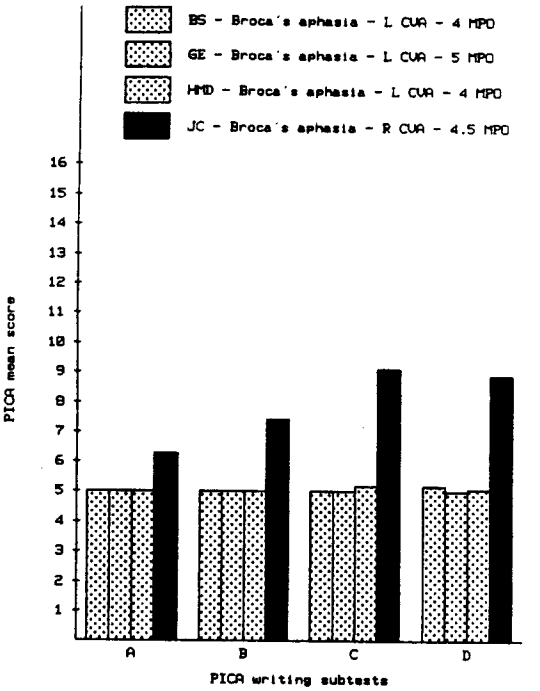
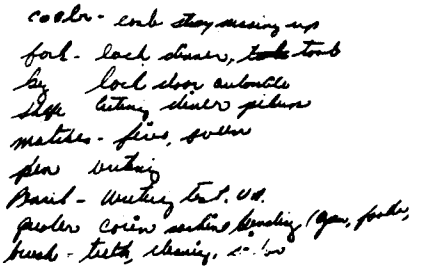


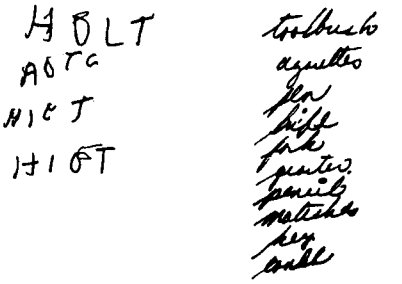
Figure 2. PICA writing subtest data for Patient J.C. and three left-hemisphere cohorts.



Patient B.S.
Broca's - L CVA

Patient J.C.
Broca's - R CVA

Figure 3. Writing samples from PICA subtest A by Patient J.C. and a left-hemisphere cohort.



Patient H.M.D.
Broca's - L CVA

Patient J.C.
Broca's - R CVA

Figure 4. Writing samples from PICA subtest C by Patient J.C. and a left-hemisphere cohort.

In the group with Wernicke's aphasia (Figure 5), we again see no marked difference among patients on the reading tasks but a more substantial difference is apparent on the writing tasks (Figure 6). Comparison of these patients' writing (Figure 7) reveals better performance by the right hemisphere patient than either of the left hemisphere patients. B.W. drew the cigarette instead of describing what to do with it and then refused to perform the task. Subtest C (Figure 8) also shows differences among patients. The right hemisphere patient, F.D., stays on task better and produces more recognizable words (pen, pencil, key, etc.) with fewer jargon and perseverative responses than either left hemisphere patient.

In the subcortical group, we see only slightly better performance on one of the reading tasks (Figure 9) by our crossed aphasic patient, A.M., compared with A.L., the left hemisphere patient, though, again, far superior performance by A.M. is exhibited on the writing tasks (Figure 10). This difference is seen clearly in the writing samples (Figures 11, 12).

We next sought to determine whether this difference between comprehension and expression might be reflected in other modalities. Figure 13 shows the performance of the Broca's aphasic patients on the PICA auditory comprehension subtests. The instructions for the auditory comprehension subtests are: Subtest VI: "Point to the one used for ... (ex. cleaning teeth)." Subtest X: "Now I'll say the name of each one and you point to it." The difference between the crossed aphasic patient and the left hemisphere patients is not marked on these tasks. But comparison of verbal performance (Figure 14) shows striking differences between the left hemisphere patients and the right hemisphere patient on 4 tasks of verbal expression. The instructions for the verbal subtests are: Subtest I: "As completely as possible, tell me what you do with each of these." Subtest IV: "Tell me the name of each of these." Subtest IX: "Finish these sentences: (ex. You clean teeth with a _____)." Subtest XII: "Now I'll say the name of each one and you say it after me." This dissociation between the left and right hemisphere aphasic patients on tasks of verbal expression, but not auditory comprehension, is evident in the Wernicke's and the subcortical aphasic patients as well. In Figure 15, we see little difference between the left- and right-hemisphere-damaged Wernicke's aphasic patients on the auditory comprehension subtests. But there is a larger distinction between these groups on 2 of the 4 verbal subtests (Figure 16). Similarly, in the subcortical patients (Figure 17), we see no difference between left- and right-hemisphere patients on the auditory tasks, while there are obvious differences on the verbal subtests (Figure 18).

DISCUSSION

Our intention was to examine if quantitative or qualitative differences might exist between crossed aphasic patients and matched aphasic patients with left hemisphere lesions. What we found were two crossed aphasic patients and one left-handed aphasic patient with a right hemisphere lesion who fit into classic aphasia typologies, but who demonstrated consistently superior performance on tasks of writing and oral expression. This difference suggests interesting interhemispheric differences. First, the patients with right hemisphere lesions appear to be less aphasic than their left hemisphere damaged cohorts -- as reflected in their Overall PICA score -- even though the intrahemispheric location and size of the lesion, type of aphasia, and time postonset were comparable. This difference can be accounted for by the right hemisphere patients' superior ability in oral and written expression,

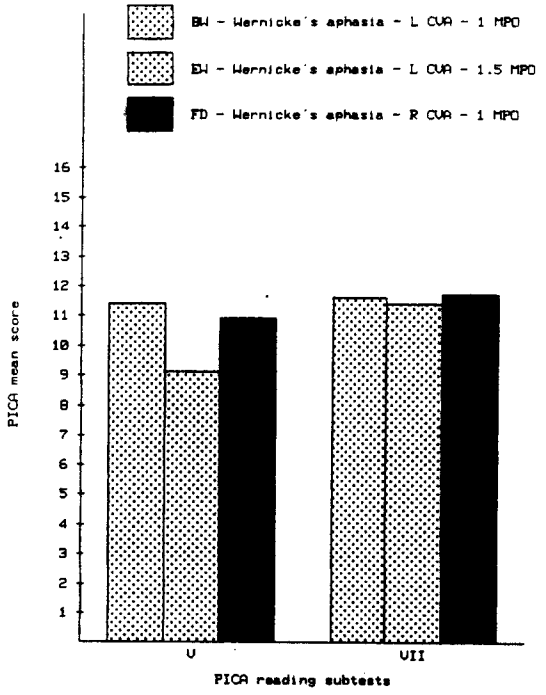


Figure 5. PICA reading subtest data for Patient F.D. and two left-hemisphere cohorts.

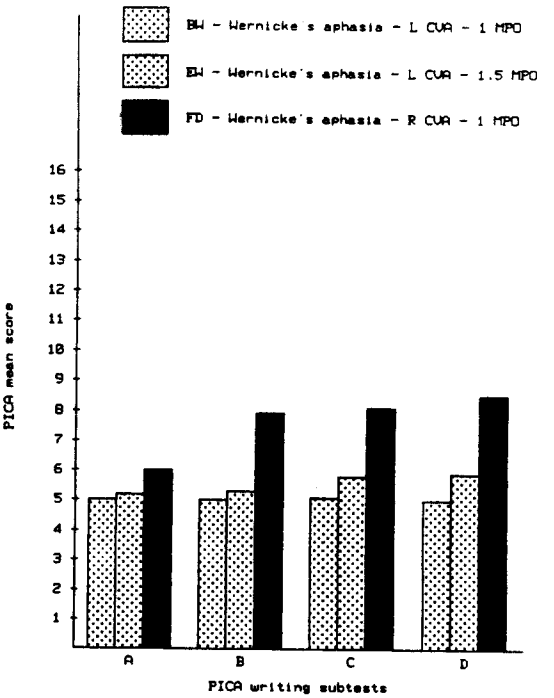


Figure 6. PICA writing subtest data for Patient F.D. and two left-hemisphere cohorts.

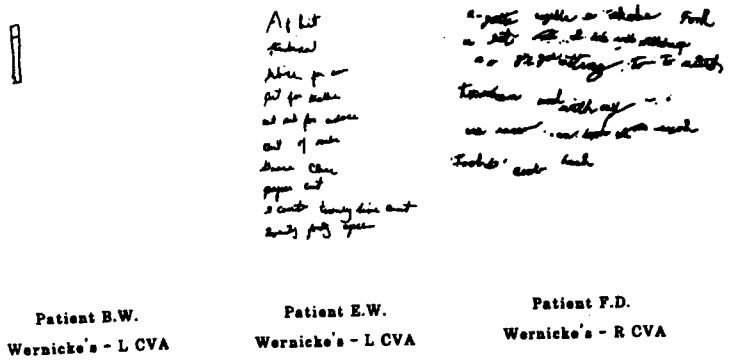


Figure 7. Writing samples from PICA subtest A by Patient F.D. and two left-hemisphere cohorts.

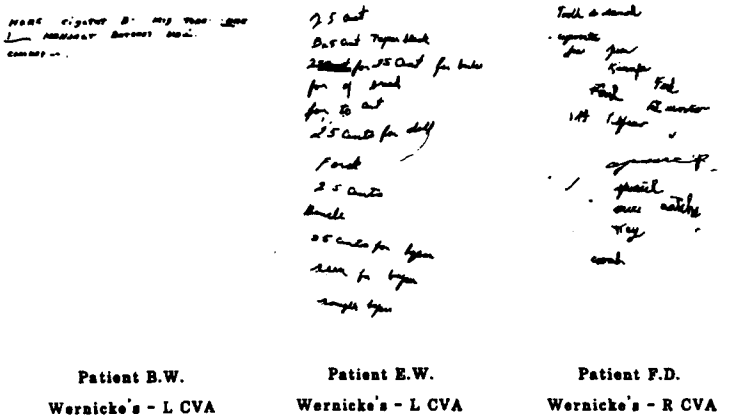


Figure 8. Writing samples from PICA subtest C by Patient F.D. and two left-hemisphere cohorts.

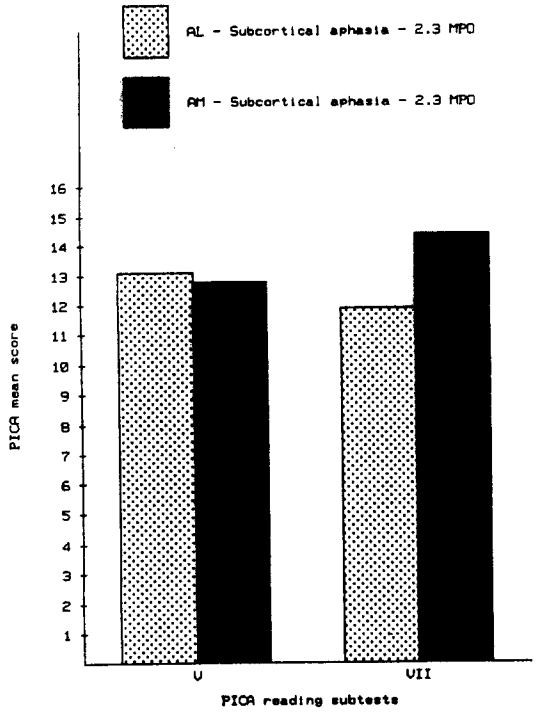


Figure 9. PICA reading subtest data for Patient A.M. and a left-hemisphere cohort.

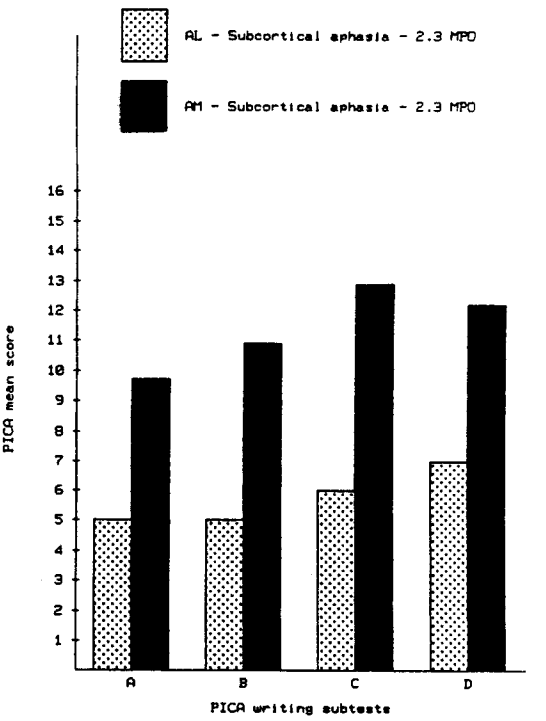
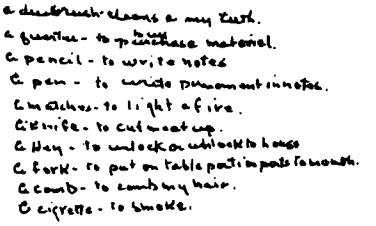


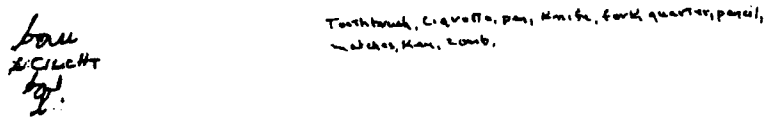
Figure 10. PICA writing subtest data for Patient A.M. and a left-hemisphere cohort.



Patient A.L.
Subcortical - L CVA

Patient A.M.
Subcortical - R CVA

Figure 11. Writing samples from PICA subtest A by Patient A.M. and a left-hemisphere cohort.



Patient A.L.
Subcortical - L CVA

Patient A.M.
Subcortical - R CVA

Figure 12. Writing samples from PICA subtest C by Patient A.M. and a left-hemisphere cohort.

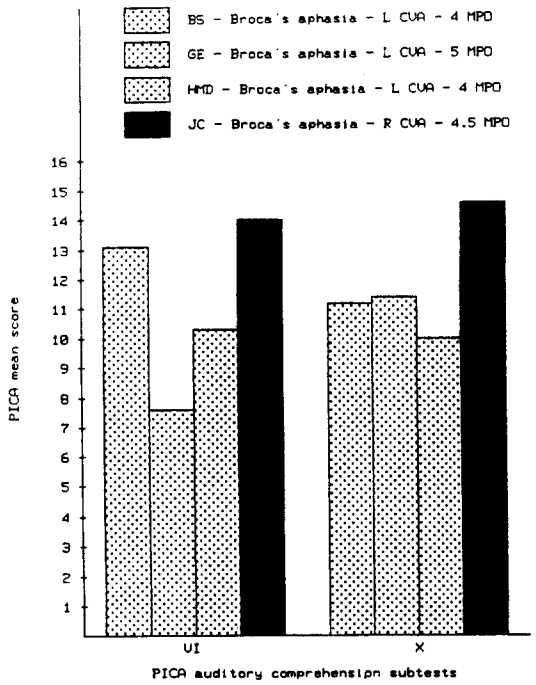


Figure 13. PICA auditory comprehension subtest data for Patient J.C. and three left-hemisphere cohorts.

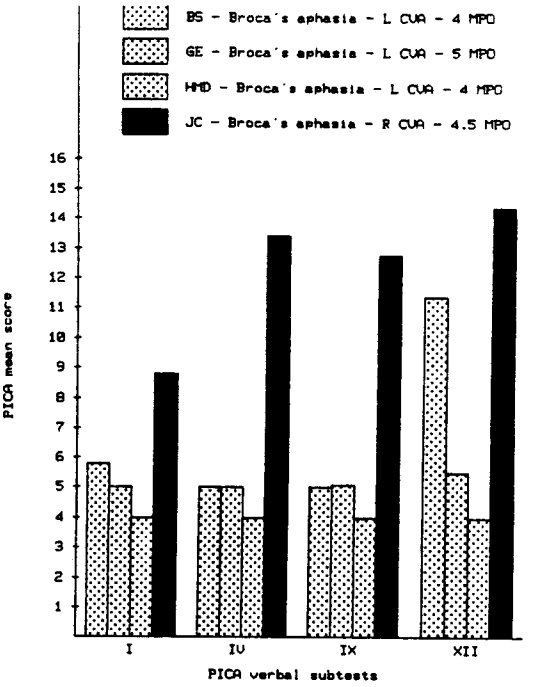


Figure 14. PICA verbal subtest data for Patient J.C. and three left-hemisphere cohorts.

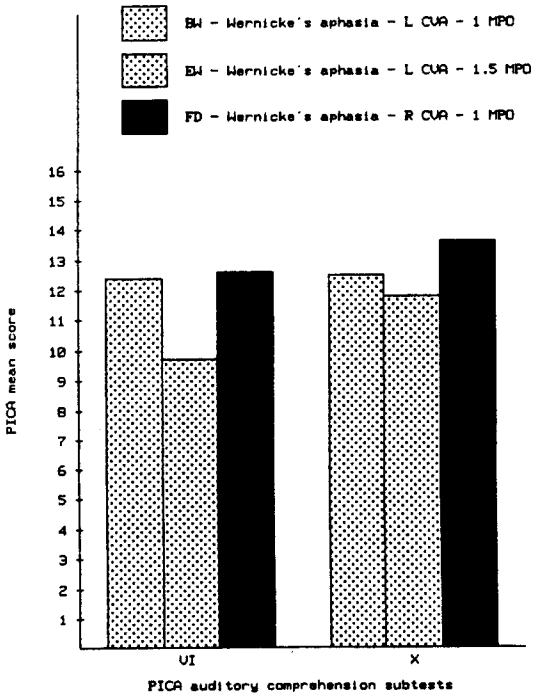


Figure 15. PICA auditory comprehension subtest data for Patient F.D. and two left-hemisphere cohorts.

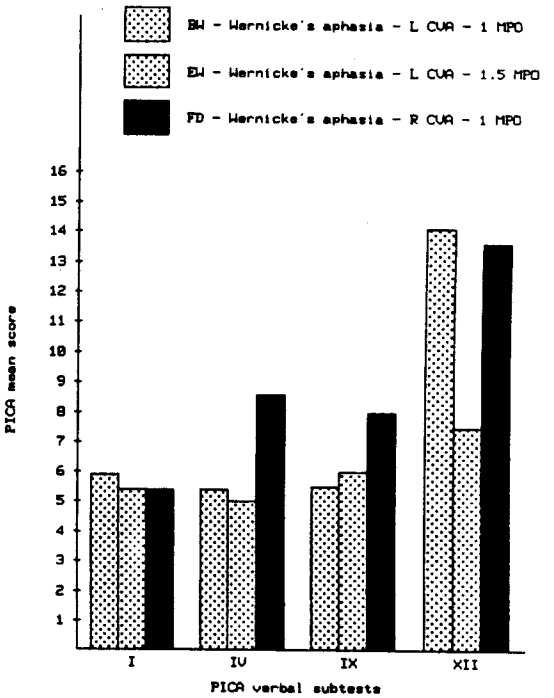


Figure 16. PICA verbal subtest data for Patient F.D. and two left-hemisphere cohorts.

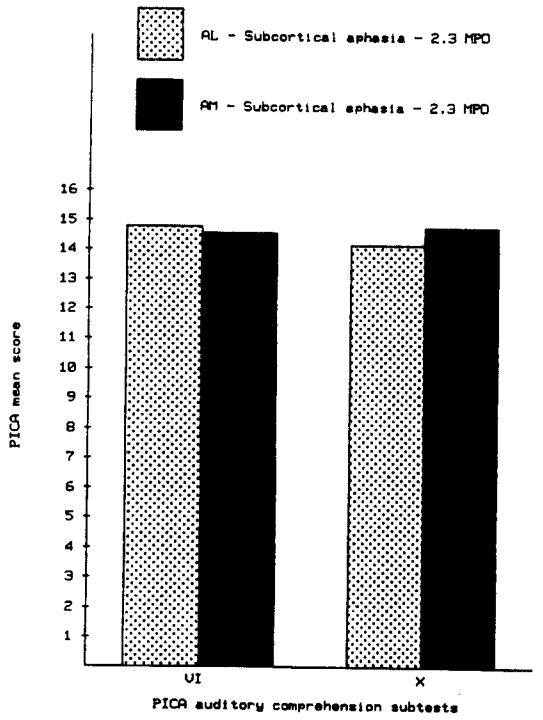


Figure 17. PICA auditory comprehension subtest data for Patient A.M. and a left-hemisphere cohort.

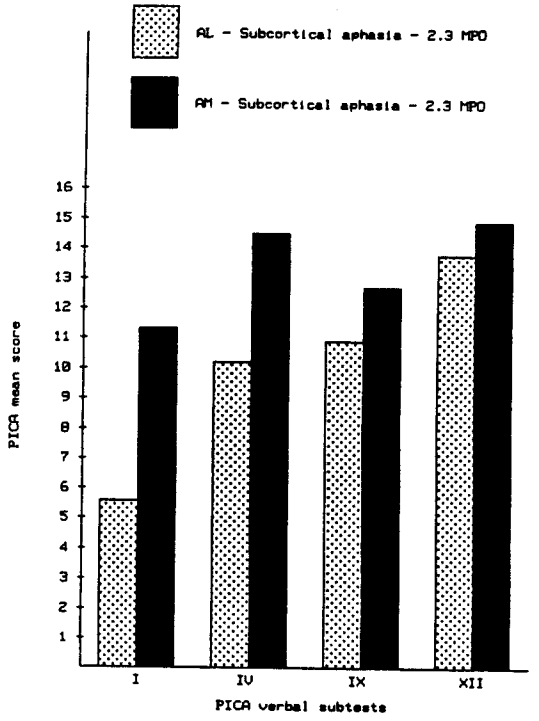


Figure 18. PICA verbal subtest data for Patient A.M. and a left-hemisphere cohort.

as few, overall differences existed between the right and left hemisphere patients in reading or auditory comprehension. Thus, our first conclusion is that aphasia in crossed aphasic patients and in left-handed aphasic patients with right hemisphere lesions may be less severe than in left hemisphere damaged aphasic patients, and this difference can be accounted for by the right hemisphere patients' superior expressive skills.

Second, left hemisphere and right hemisphere patients showed similar impairment in receptive language. However, none of the left hemisphere patients showed the expressive ability seen in the right hemisphere patients. We believe this indicates the preserved ability in the right hemisphere patients to not only access but to express the lexicon through oral or written means. Both left and right hemisphere patients could pick out the correct item if given the name, but only the right hemisphere lesioned patients could actually produce the name. Thus, our second conclusion is that crossed aphasic patients and left-handed aphasic patients with right hemisphere lesions do not demonstrate the striking difference between lexical access and expression seen in left hemisphere aphasic patients.

This issue of whether or not left and right hemisphere aphasic patients are alike obviously cannot be answered by the few patients discussed here. However, these cases do give us an indication of the potential differences between aphasia subsequent to left hemisphere damage and aphasia from right hemisphere damage. Although crossed aphasic patients may fit nicely into typologies designed for the left hemisphere damaged patient, the differences we have noted, particularly in the realm of oral and written expression, urge us to acknowledge that the aphasia observed in right hemisphere lesioned patients is indeed "unusual."

ACKNOWLEDGMENT

The author wishes to acknowledge the valuable contributions of Robert T. Wertz, Patricia M. McAleese, and Robert T. Knight towards the completion of this manuscript.

REFERENCES

Benson, D. and Geschwind, N. Aphasia and related disturbances. In A. Baker (Ed.), Clinical Neurology. New York, NY: Harper and Row, 1972.

Boller, F. Distruction of Wernicke's area without language disturbance. A fresh look at crossed aphasia. Neuropsychologia, 11, 243-246, 1973.

Bramwell, B. On crossed aphasia. Lancet, 803-805, 1899.

Brown, J.W. and Hecaen, H. Lateralization and language representation. Neurology, 26, 183-189, 1976.

Brown, J. and Wilson, F. Crossed aphasia in a dextral. A case report. Neurology, 23, 907-911, 1973.

Delis, D.C., Knight, R.T., and Simpson, G. Reversed hemispheric organization in a left-hander. Neuropsychologia, 21, 13-24, 1983.

Gloning, I., Gloning, K., Haub, G., and Quatember, R. Comparison of verbal behavior in right-handed and non right-handed patients with anatomically verified lesion of one hemisphere. Cortex, 5, 43-52, 1969.

Haaland, K.Y. and Miranda, F. Psychometric and CT scan measurements in a case of crossed aphasia in a dextral. Brain and Language, 17, 240-260, 1982.

Han, M. and Foo, S. Negative evidence for language capacity in the right hemisphere: Reversed lateralization of cerebral function. In E. Perecman (Ed.), Cognitive Processing in the Right Hemisphere. New York, NY: Academic Press, Inc., 1983.

Hecaen, H., Mazurs, G., Ramier, A., Goldblum, M., and Merienne, L. Aphasie croisee chez un sujet droitier bilingue. Revue Neurologique, 1, 319-323, 1971.

Naeser, M.A. and Borod, J.C. Aphasia in left-handers: Lesion site, lesion side, and hemispheric asymmetries on CT. Neurology, 36, 471-488, 1986.

Porch, B.E. Porch Index of Communicative Ability. Palo Alto, CA: Consultint Psychologists Press. Revised 1973.

Zangwill, O. Speech and the minor hemisphere. Acta Neurologica et Psychiatrica Belgica, 67, 1013-1020, 1967.