RECOVERY FROM APHASIA RESULTING FROM ARTERIOVENOUS MALFORMATION: A REPORT OF THREE CASES

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Arteriovenous malformations (AVM) are developmental abnormalities in which the normal separation of afferent from efferent vascular channels fails to occur. They can be symptomatic at any age, and, of all intracranial vascular anomalies, they are second in frequency only to congenital saccular aneurysms. They may be located either on the surface of the cerebral hemispheres or in the deep structure. They range in size from barely visible to large enough to replace an entire hemisphere. During life, these vessels are markedly enlarged and distended with blood, presenting a writhing appearance of coiled snakes (Figure 1). Because oxygenated blood is shunted directly to the veins without passing through a capillary bed, the veins are often large and contain bright red blood under relatively high pressure (Toole and Patel, 1967)

Most of the large AV malformations produce some signs and symptoms during life. These include: intracerebral, subarachnoid or subdural hemorrhage; convulsions; headaches; focal neurologic signs such as weakness, sensory loss, aphasia, hemianopsia, etc.; and dementia. In about half of the patients between the ages of 20 and 30, the AVM remains inactive until hemorrhage occurs. Most often, the bleeding is from a ruptured vein, therefore the hemorrhage is less severe than that from a saccular aneurysm or from rupture of the arterial portion of the malformation (Dandy, 1969; Toole and Patel, 1967).

In 25 to 40 percent of the patients, a convulsion is the initial symptom. This typically occurs in adolescence or young adult life. Because malformations often are located in the parietal or occipital regions, focal events may be auditory or visual in nature (Toole and Patel, 1967).

Migraine-like headaches are the initial symptoms in about 15 percent of the patients. When vascular headaches and seizure occur in the same patient, the possibility of an AVM should always be considered. In a young adult, throbbing headaches occurring in the same location may suggest intracranial vascular disease and, frequently an AVM. (4)

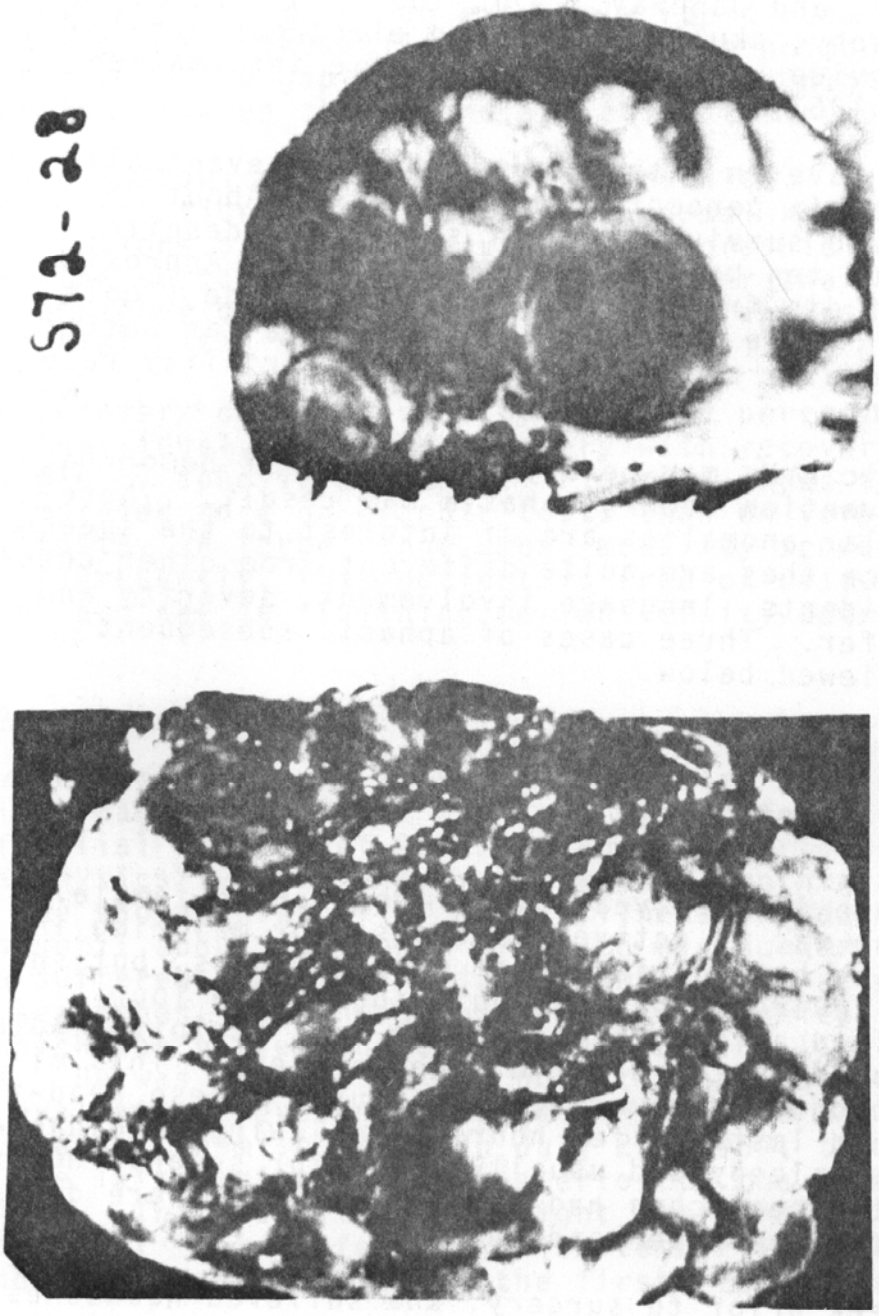

FIGURE 1. Shown above is a medial view of an AVM in the left occipital lobe. Shown below is a lateral view of an AVM in the left occipital lobe.

Typically, an AVM is identified and localized by arteriography. Another useful procedure is the radioactive brain scan (Toole, Mossy, and Janeway, 1971; Toole and Patel, 1967). Pneumoencephalography, skull x-rays, and electroencephalography usually provide very little diagnostic information (Toole and Patel, 1967).

Patients who have an intracranial AVM that eventually hemorrhages show a six percent mortality rate. About 25 percent of those who survive are self supporting despite symptoms, and about ten percent become invalids. Approximately six percent die from a subsequent hemorrhage (Toole and Patel, 1967). These prognostic figures are far better than those for saccular aneurysms, where the mortality rate is about 20 percent.

Prehemorrhagic AVMs may be asymptomatic. If hemorrhage or surgical intervention occur, aphasia may result. Therefore, these vascular anomalies are of interest to the speech pathologist. Since they are quite different from other cerebral vascular accidents, language involvement, severity and recovery also differ. Three cases of aphasia subsequent to an AVM are reviewed below.

Case Reports

Case One

The first case is a 24 year old, right-handed female. Prior to onset she was an active college senior majoring in art education. She had no history of major illness, but she had a history of severe headaches beginning at age four. These were described as initiating at the left occipital pole and migrating around to the orbit of the left eye. This migrating process progressed over several hours. These headaches were rare and lasted a few hours. Following a headache, the patient became sleepy and usually slept for several hours. Upon awakening, the headaches had subsided. These were diagnosed as being migraine-type headaches.

About one week prior to surgery, she suffered headaches of greater intensity and frequency. They were accompanied by flashes of light appearing in the right visual field. Neurologic evaluation revealed a massive AVM located throughout the entire left occipital lobe. No hemorrhage was apparent at that time. On January 3, 1972 surgery was performed and the left occipital lobe up to and slightly under the angular gyrus was excised.

Nine days postsurgery, she was given the first twelve subtests of the Porch Index of Communicative Ability (PICA)

(Porch, 1967). The graphic subtests were given the following day. Her recovery is charted in Figure 2. Three PICAs were administered within a one and one-half month period. The recovery profile illustrates an extremely rapid recovery which peaked at the 95th percentile at seven weeks postonset. A very narrow high-low gap (dynamic range) and a high-low reversal occurring between the second and third tests were observed.

Figure 3 shows modality raw score results. Each modality is shown in relation to a hypothetical normal response of 15 and illustrations of gestural, verbal and graphic hierarchy. Note that the verbal scores were higher after the second test and remain higher on the third test. The graphics and gesturals were essentially the same on the third test.

The recovery curve charted by modality percentile compares an individual patient's recovery with recovery by a large sample of aphasic patients. Figure 4 shows that the patient improved more on graphic tests than on verbal and gestural tests. A large range among modality scores is apparent. Presently, this patient is free of seizures and headaches, and she is finishing her university degree program.

Case Two

The second case is a 24 year old Spanish American male with a left hand, left foot, and left eye preference. There was no familial history of left handedness. Prior to onset, he was a physically active army man with a tenth grade education. He had no history of major illness, headaches, or seizures until about one month prior to his surgery. At this time, he suffered grand mal seizures which were accompanied by intense headaches. The headaches were accompanied by auditory events which the patient described as sounding like the beating of drums. He was brought to the hospital unconsious. Neurological evaluation revealed a large AVM located in the parietal area of the left hemisphere. On July 29, 1969, the major portion of the left parietal lobe posterior to the Sylvian fissure was excised. This resulted in a right hemiparesis with no apparent visual field defects. On September 16, 1969, about a month and a half after surgery, the first PICA was administered.

Figure 5 illustrates the patient's PICA recovery curve shown in percentile scores. Note the rapid recovery during the first three and one-fourth months. After the fourth month, minimal recovery occurred and there was a narrow range. The recovery curve by modality score (Figure 6) illustrates the remarkable recovery in the verbal modality. Figure 7 shows recovery expressed in modality percentiles. Again, the gains in the verbal modality are observable, however they are less dramatic when expressed as a percentile score. Further, the

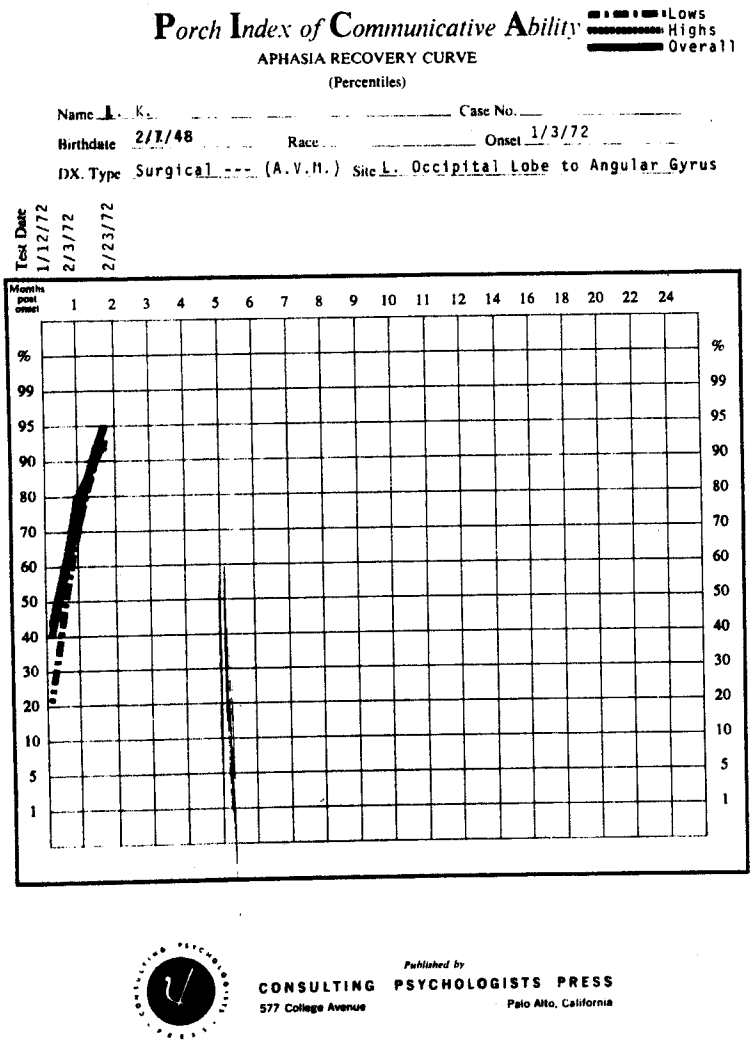

FIGURE 2. PICA Recovery Curve showing PICA Overall, High, and Low percentiles for Case One.

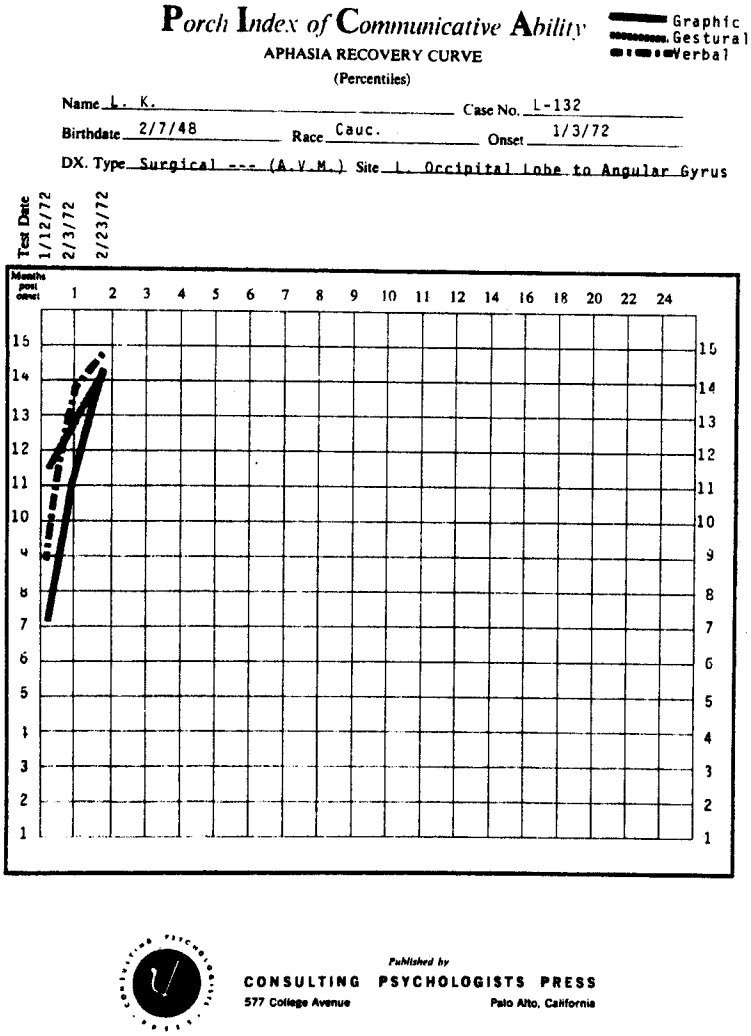

FIGURE 3. Aphasia Recovery Curve showing PICA modality raw scores for Case One.

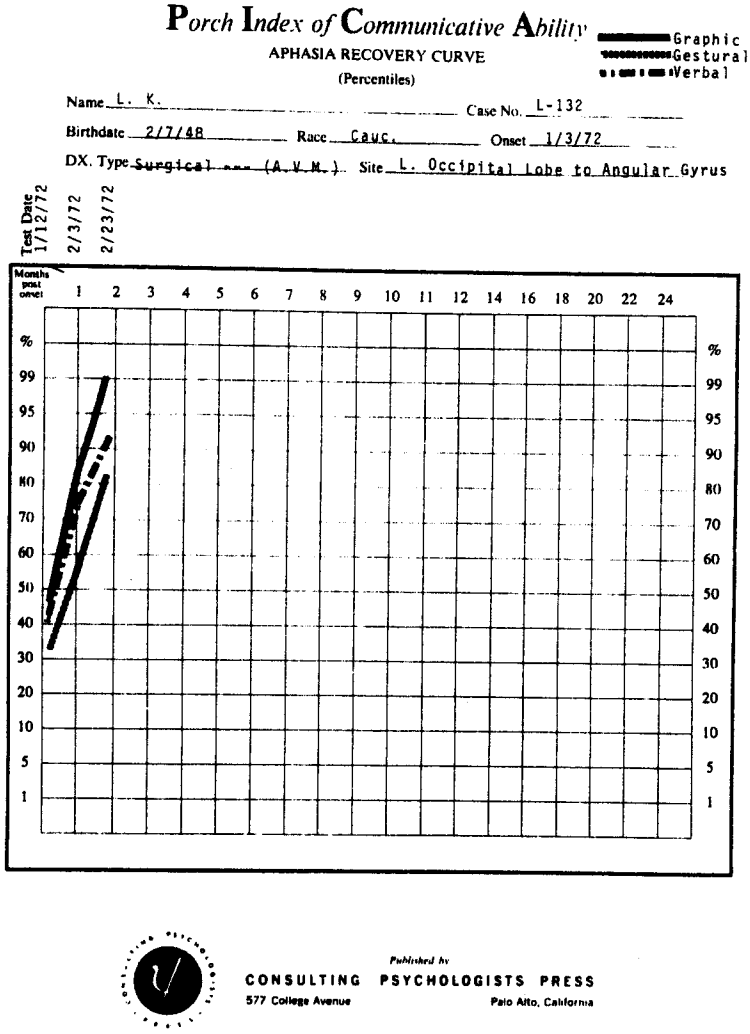

FIGURE 4. Aphasia Recovery Curve showing PICA modality percentiles for Case One.

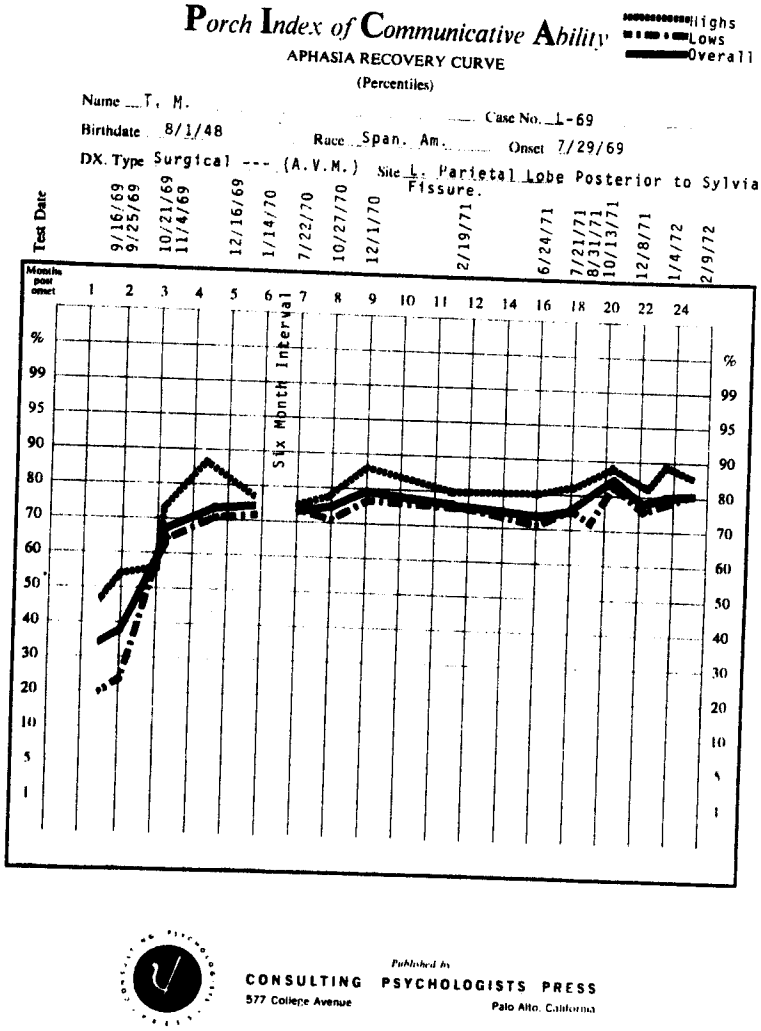

FIGURE 5. Aphasia Recovery Curve showing PICA Overall, High, and Low percentiles for Case Two.

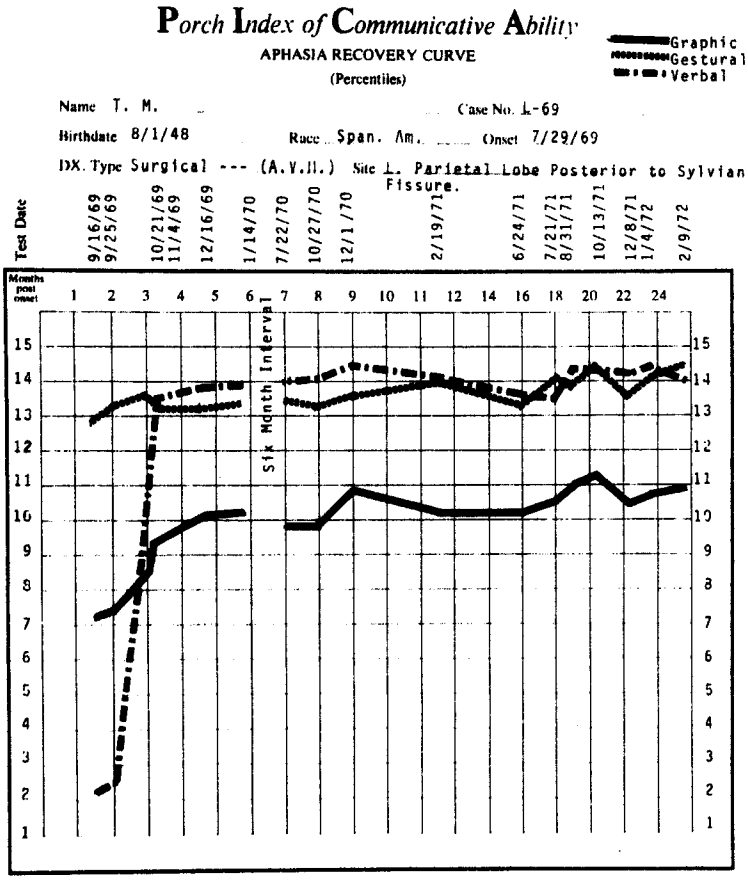

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FIGURE 6. Aphasia Recovery Curve showing PICA modality raw scores for Case Two.

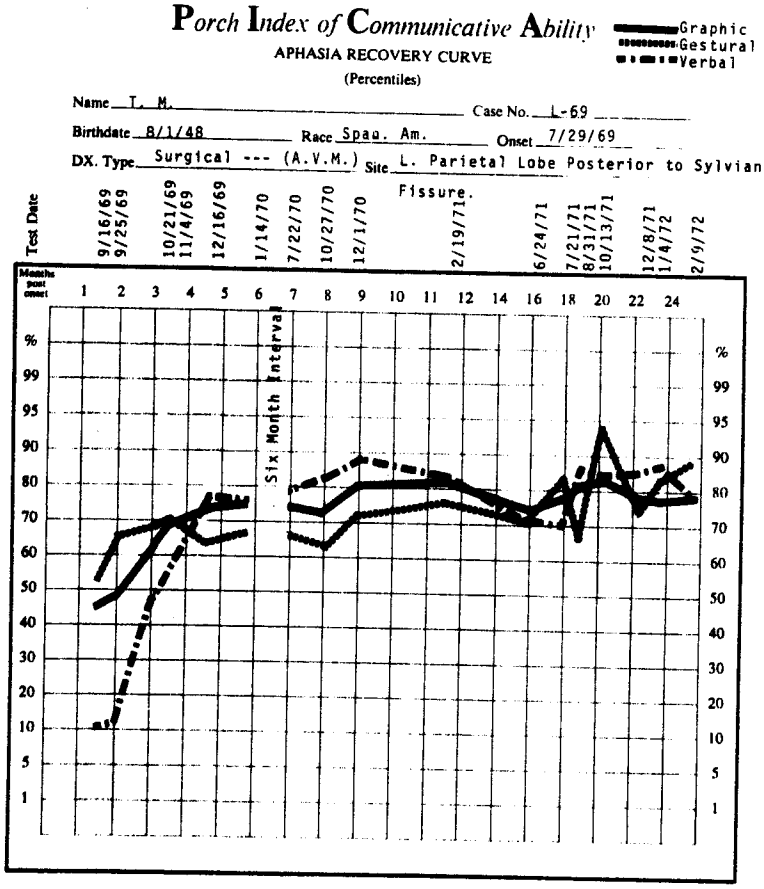

FIGURE 7. Aphasia Recovery Curve showing PICA modality percentile for Case Two.

differences among modalities are not as apparent when performance is converted to percentile. This patient continued to suffer grand mal seizures after surgery, however these are presently under control with medication. He is presently receiving speech therapy.

Case Three

The third case is a 26 year-old right-handed, Spanish American male. Prior to onset he was a physically active assistant restaurant manager. His education includes a high school diploma plus some business courses at the college level. He had no history of major illness, but he had suffered severe headaches for five years. These occurred two or three times a month.

On November 24, 1971, the patient was eating dinner when a sudden onset of choking occurred. He collapsed in a semiconscious state and was taken to the hospital when he was diagnosed as having a right-sided hemiparesis and aphasia. He remained semiconscious for a day and one-half. During this time, he was given a left carotid angiogram which revealed a small AVM located in the left posterior frontal area. There was a significant blood clot within the substance of the brain which caused a shift and depression of the temporal lobe. On November 26, 1971, a left frontal craniotomy resulted in excision of the AVM and removal of an intercerebral hematoma.

Figure 8 shows the patient's PICA recovery curve graphed by percentile. A rapid recovery can be seen within the first three months. The high-low reversal occurring between the second and third month, characteristic of all three cases, is also apparent. The recovery curve, plotted by modality scores, (Figure 9) illustrates rapid recovery of the verbal ability between the first and second month. Gestural performance began highest and remained so. There was marked improvement in graphic performance occurring between the second and third months. Modality recovery charted by percentiles (Figure 10) offers a slightly different look at the same test performance. Rapid recovery of verbal and graphic abilities is still obvious during the first three months postonset.

Comparison of Cases

The overall percentiles for all three AVM patients is shown in Figure 11. The patients' outcomes appear to be dependent on their severity at onset. All show rapid improvement during the first three months.

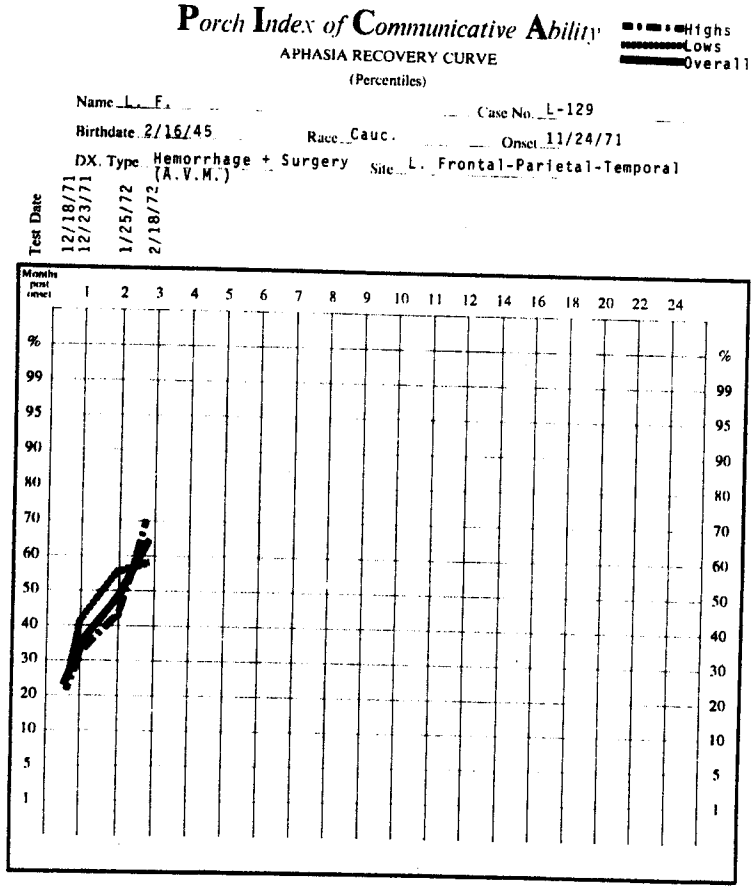

FIGURE 8. Aphasia Recovery Curve showing PICA Overall, High, and Low percentiles for Case Three.

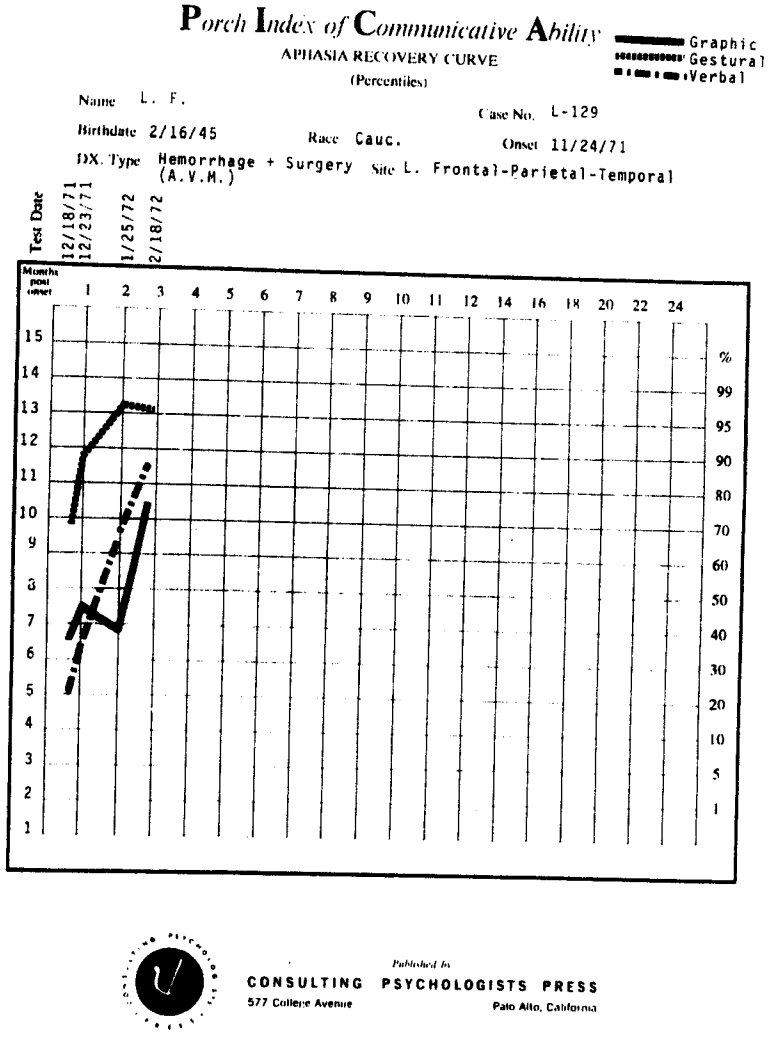

FIGURE 9. Aphasia Recovery Curve showing PICA modality raw scores for Case Three.

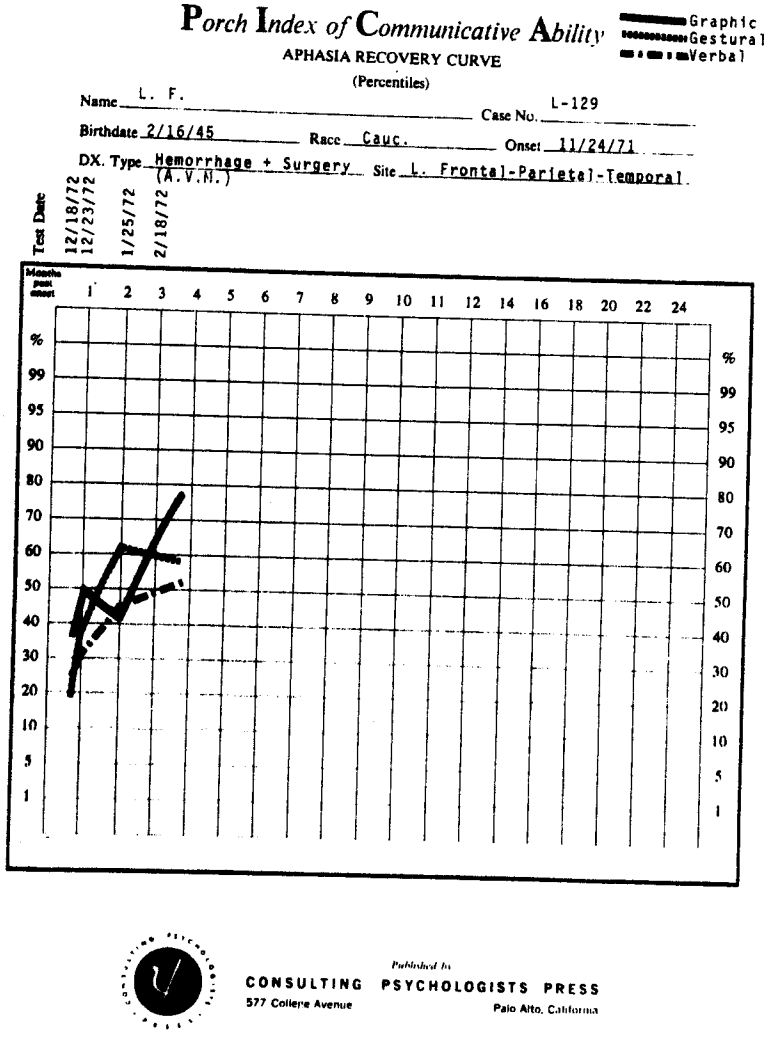

FIGURE 10. Aphasia Recovery Curve showing PICA modality percentiles for Case Three.

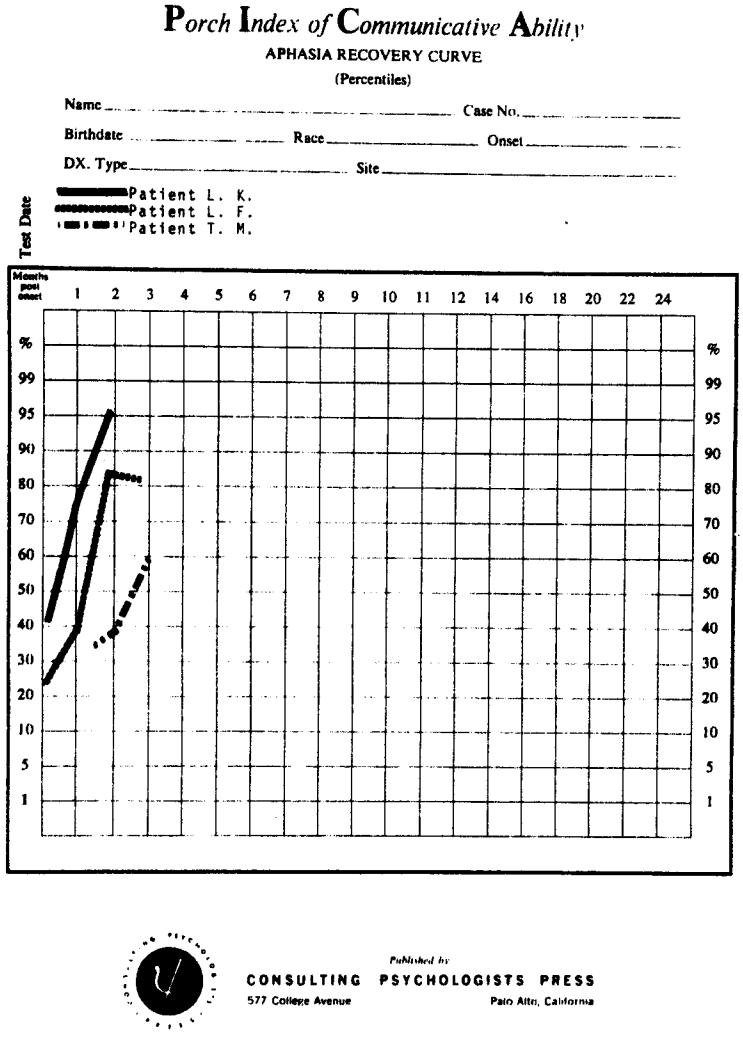

FIGURE 11. Aphasia Recovery Curves showing Overall percentile scores for three cases of AVM.

Figure 12 contrasts recovery in AVM with recovery from other etiologies. Overall, high, and low percentiles shown for the "typical" trauma, thrombosis, hemorrhage, and AVM patients.

Discussion

Prognosis for recovery of speech and language in AVM patients may be better than for patients who have suffered a thrombosis, trauma, or hemorrhage. The three cases presented displayed rapid improvement, especially in language abilities that should have remained impaired. For example, the first case underwent a left occipital lobectomy anterior to the angular gyrus, however she read and wrote very well seven weeks after surgery. The third case had Broca's area removed and had a depressed temporal lobe, however he was only mildly aphasic, relatively fluent, and demonstrated few auditory problems. When hemorrhage does occur in AVM patients, it usually results from a single vein. Therefore, there is less pressure and less surrounding damage. Further, AVM patients are relatively young when the symptoms appear. Finally, there is less mortality in AVM than in other vascular disorders such as saccular aneurysms.

There were several similarities among the three cases presented. First, all three showed rapid recovery within the first three months postonset, and all three showed a narrow dynamic range. Second, there was consistent, orderly recovery in all modalities. Gestural performance improved first followed by verbal and graphic abilities. If these consistencies are supported by a larger sample, prediction of eventual recovery level for AVM patients would be quite possible. Third, then each case displayed a high-low reversal within the first three months postonset. This resulted from rapid improvement in the tremendous graphic ability. This might provide a means for predicting eventual recovery and differential diagnosis among etiologies.

From the data on three patients, a few observations about the nature of arteriovenous malformation have been made. Only careful observation and systematic collection of data on additional AVM patients will determine whether or not these initial observations are distinctive features of recovery in arteriovenous malformation.

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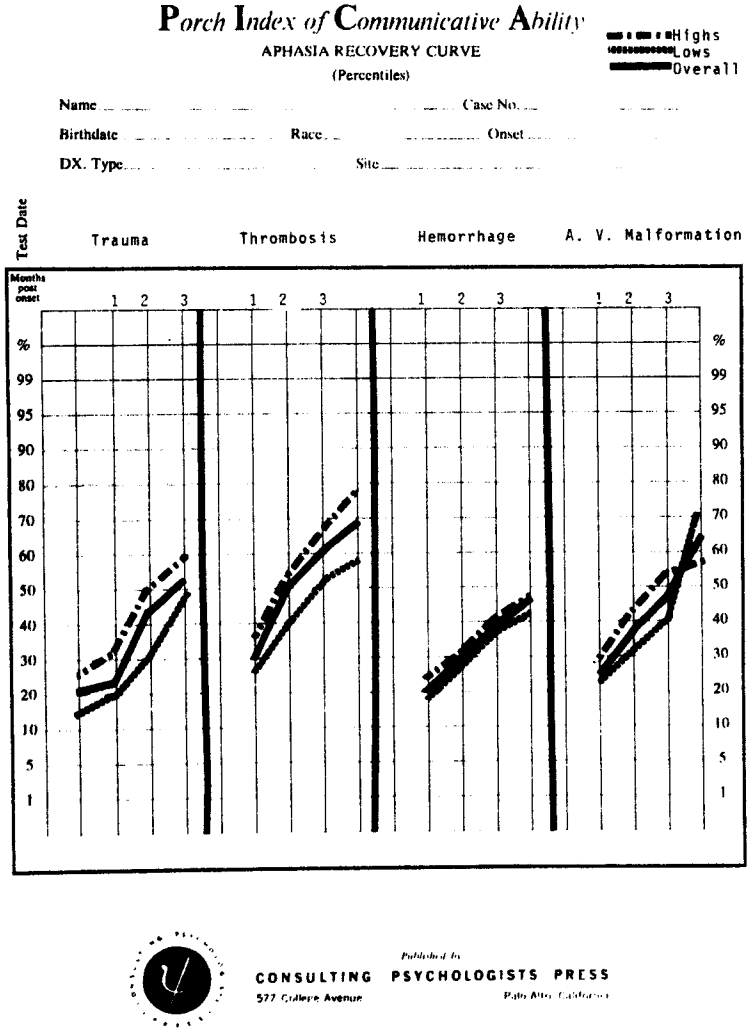

FIGURE 12. Aphasia Recovery Curves showing Overall, High, and Low percentiles for "typical" cases of trauma, thrombosis, hemorrhage, and AVM.

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