Differentiating Aphasia and the Language of Generalized Intellectual Impairment

Jon L. Deal and Robert T. Wertz
Veterans Administration Medical Center, Martinez, California

Carl Spring
University of California, Davis, California

Implicit in the thinking of most aphasiologists is the concept that the various neurogenic disorders of speech and language possess differential characteristics that permit differentiation within and among disorders. This concept appears in aphasia (Goodglass and Kaplan, 1972) and in dysarthria (Darley, Aronson, and Brown, 1975). It has also been applied to other neurogenic speech and language disorders (Halpern, Darley, and Brown, 1973). Speech pathologists are often called upon to assist in determining whether a patient presents aphasia or whether he suffers from a generalized intellectual impairment.

Halpern, Darley, and Brown attempted to provide data concerning differential language characteristics. They suggested that it may be possible to differentiate among the language of aphasia, the language of generalized intellectual impairment, the language of confusion, and apraxia of speech on the basis of subtest profiles. They administered a modification of Schuell's short aphasia evaluation to obtain the data used to establish language profiles for each of their four groups. Ten subtests were administered to measure auditory retention, auditory comprehension, reading comprehension, naming, writing to dictation, arithmetic, syntax, adequacy, relevance, and fluency.

Halpern et al. (1973) based their diagnoses of 40 patients on these profiles. To validate this diagnostic use of the profiles, they demonstrated that their diagnoses agreed with the independent diagnoses of a neurologist. Unfortunately, it is not known whether neurological data or patients' histories were known by the person who used subtest profiles to make the original diagnoses. Nor is it known whether the original diagnoses could have been influenced by behavior other than that reflected in the subtest profiles that may have been observed while administering the test. The suggestion that subtest profiles differentiate among language disordered groups would be supported only if the original diagnoses were based solely on subtest profiles.

In addition, the group profiles reported by Halpern et al. (1973) for each of their four language disorder groups were based on the mean subtest scores of only 10 patients per group. Finally, no statistical tests were reported that would demonstrate that the profiles of patients within a language disorder group were more similar than profiles of patients in different groups.

Given these limitations of the study by Halpern et al. (1973), we concluded that their results need cross-validation. The purpose of the present study, therefore, was to cross-validate the power with which their reported group profiles discriminate between patients from our clinic who

had previously been diagnosed as belonging to two of those language disorder groups. The two language disorder groups that were studied in the present investigation were aphasia and the language of generalized intellectual impairment.

METHOD

To test the hypothesis that aphasia and generalized intellectual impairment may be discriminated by test profiles, we administered the same test battery as Halpern, et al.. However, we administered the test battery after the subjects had been assigned to one of two groups, aphasia or generalized intellectual impairment. We did not study the language of confusion or apraxia of speech.

Subjects. A total of 36 subjects participated in the study. Twenty-one were diagnosed as aphasic and 15 were diagnosed as demonstrating generalized intellectual impairment. All subjects were given a battery of speech and language measures which did not include the Halpern, Darley, and Brown battery. Each subject's performance on the battery, his medical data, and his biographical data were used to label him as demonstrating aphasia or the language of generalized intellectual impairment. After the subjects were placed into one of the two groups, the test battery used by Halpern, Darley, and Brown was administered.

Data Analysis. Biographical data consisting of age, months postonset, handedness, and medical data consisting of the basis for diagnosis, rapidity of onset, handedness change, hemispheric localization, type of lesion, and etiology were collected to provide descriptive data for subjects in each of the two groups.

Q-correlations were used to test the discriminatory power of the group profiles reported by Halpern et al. (1973). Unlike R-correlations which are computed between variables and across cases, Q-correlations are computed between cases and across variables. Q-correlations may be used, therefore, as an index of similarity between profiles of two individuals, or as in the present application, as an index of similarity between the profiles of each of our patients and the group profiles reported by Halpern et al.. Thus we computed Q-correlations between each patient's profile and the group profile for aphasia reported by Halpern et al. (1973). Similarly, we computed Q-correlations between each patient's profile and the group profile for generalized intellectual impairment reported by Halpern, et al.. We hypothesized that the profiles of our aphasia patients should correlate more strongly with the Halpern et al. group profile for aphasia than with their group profile for generalized intellectual impairment. The contrasting pattern was expected for our generalized intellectual impairment subjects. Our hypotheses was evaluated by a chi square test.

RESULTS

Table 1 provides age and months postonset data for the 36 subjects. The mean age of the generalized intellectual impairment group was significantly greater ($t(34\ df) = 2.13$, $p < .05$) than the mean age of the aphasic subjects. The two groups were similar in months postonset.

Table 1. Age and months postonset of subjects in each group.

	Aphasia (N = 21)	Gen. Intell. Imp. (N = 15)
Age (Years)		
Mean	57.3	63.9
S.D.	9.4	8.4
% 60+	5	27
% 45 - 60	90	73
% -45	5	0
Months Postonset		
% more than 20 months	38	33
% less than 20 months	62	67

Table 2 provides the neurological characteristics of both groups. All aphasic subjects had rapid onset, within 10 days; however, 87 percent of the generalized intellectual impairment subjects had slow onset of symptoms. More than 50 percent of the aphasic subjects had a handedness change from right to left hand after onset. There was no postonset handedness change for 87 percent of the generalized intellectual impairment subjects. All of the aphasic subjects had focal left hemisphere lesions, and 86 percent of those lesions were infarcts. None of the generalized intellectual impairment subjects had a unilateral left hemisphere lesion; 93 percent of their lesions were bilateral and 93 percent were either diffuse or disseminated. The etiology of the lesions of the generalized intellectual impairment subjects was usually multiple infarcts or degeneration.

Table 3 contains the mean error scores for both groups. As a group, the aphasic subjects made more errors on each of the ten subtests than did the generalized intellectual impairment group. On the reading comprehension, written dictation, and arithmetic subtests, the mean percent errors between groups did not differ significantly. On all other subtests, the aphasic group made significantly ($p<0.05$) more errors.

The mean number of total errors for our aphasia group was significantly greater than the mean number of total errors for the Halpern, Darley, and Brown aphasia group (t (20df) = 4.53, $p<0.001$). The mean total errors for our generalized intellectual impairment group did not differ significantly (t (14df) = 1.95, $p > .10$) from their group.

To test the power of the Halpern, et al. profiles to differentiate aphasia and generalized intellectual impairment, Q-correlations were computed for all of our subjects as described above. The 36 subjects were then reclassified on the basis of the Q-correlations. If a patient's profile correlated strongly with the Halpern et al. aphasia profile, the

Table 2. Neurological characteristics of subjects.

CHARACTERISTIC	GROUPS	
	Aphasia (N = 21) % of Sample	Gen. Intell. Imp. (N = 15) % of Sample
Basis of Diagnosis		
Clinical only	71	53
CT or contrast	29	47
Onset		
Rapid (-10 days)	100	13
Slow	0	87
Handedness Change		
Right to Left	57	7
Left to Right	0	7
No Change	43	86
Hemispheric Localization		
Left Hemisphere	100	0
Right Hemisphere	0	7
Bilateral	0	93
Type of Lesion		
Focal	100	7
Diffuse	0	33
Disseminated	0	60
Etiology		
Infarct	86	33
Degeneration	0	40
Hemorrhage/Hematoma	5	0
Mixed	9	27

Table 3. Mean percent errors on test battery for aphasic and general intellectual impairment subjects.

SUBTESTS	Aphasia (N = 21)		Gen. Intell. Imp. (N = 15)		TESTS (TWO-TAILED)
	% Errors	S.D.	% Errors	S.D.	
Aud. Retention	69.8	23.7	49.4	21.2	t (34) = 2.66, $p < .025$
Aud. Comprehension	46.4	35.1	27.1	21.8	t' (33)= 2.03, $p < .05$[a]
Read. Comprehension	45.2	36.0	39.8	35.2	Not significant
Naming	43.0	39.2	14.5	18.6	t' (30)= 2.91, $p < .01$[a]
Written Dictation	62.7	39.3	46.6	42.3	Not significant
Arithmetic	71.2	27.4	55.1	30.5	Not significant
Syntax	47.8	37.6	14.9	24.1	t' (34)= 3.19, $p < .01$[a]
Adequacy	77.2	23.6	57.9	26.8	t (34)= 2.29, $p < .05$
Relevance	33.9	42.2	7.7	24.1	t' (33)= 2.36, $p < .05$[a]
Fluency	61.2	37.5	7.7	12.6	t' (26)= 6.08, $p < .001$[a]
Mean	56.0	25.3	32.6	21.1	t (34)= 2.92, $p < .01$

[a]Degrees of freedom adjusted due to violation of homogeneity-of-variance assumption in accordance with approximation by Welch (Winer, 1962).

patient was classified as aphasic. Conversely, if a patient's profile correlated strongly with the Halpern et al. group profile for generalized intellectual impairment, the patient was classified as having generalized intellectual impairment.

Table 4 contains the results of the reclassification based upon the Q-correlations. The chi square was not significant, ($p > 0.05$) although it did approach significance (X^2 (1df) = 3.2, $p < 0.10$). The profiles did reclassify 80 percent of the aphasic subjects into the aphasia group; however, the generalized intellectual impairment subjects were split so that only eight of the 15 were reclassified correctly. The Q-correlations tended to pick out the aphasic subjects, but not the generalized intellectual impairment subjects.

Table 4. Classification of patients based on Q-correlations with Halpern, et al. profiles.

DIAGNOSTIC GROUP	PROFILE MOST SIMILAR	
	Aphasia	Gen. Intell. Imp.
Aphasia (N = 21)	17	4
Gen. Intell. Imp. (N = 15)	7	8

X^2 (1df) = 3.2, $p < .10$

DISCUSSION

There were obvious nonlanguage characteristics which would differentiate between our two groups. If a young patient had a focal, left hemisphere CVA, that patient could be labeled as demonstrating aphasia, not generalized intellectual impairment, without ever analyzing his language data. None of our generalized intellectual impairment subjects had focal, left hemisphere infarcts. Our purpose, however, was to determine whether language characteristics, specifically profiles based upon the test battery administered by Halpern, Darley, and Brown, could differentiate aphasia from generalized intellectual impairment.

In our cross-validation of the Halpern et al. profiles, the results fell short of significance. We were unable to classify all our subjects correctly solely on the basis of their subtest profiles. We were able to discriminate 17 of the 21 aphasic subjects, but we were able to differentiate only eight of the 15 generalized intellectual impairment subjects. We are, of course, assuming that the diagnoses were correct prior to the analysis of the subtest profiles and the subsequent reclassification of the subjects.

The significant difference in the mean number of total errors should not have influenced these results. The Q-correlation ignores the level of performance. Our results did approach significance and we are encouraged that performance on language tests can be used to discriminate aphasia and

the language of generalized intellectual impairment. Perhaps a language battery specifically designed to differentiate between the two disorders would increase the precision with which these patients can be classified.

Because the diagnostic label applied to a patient may influence the manner in which a patient is managed, the development of an instrument which yields differential profiles might improve patient management. Darley (1979) hoped that this is one direction aphasia testing might take, and we agree.

REFERENCES

Darley, F.L. The differential diagnosis of aphasia. In R.H. Brookshire (Ed.), Clinical Aphasiology Conference Proceedings: 1979. Minneapolis, MN: BRK Publishers, 1979.

Darley, F.L., Aronson, A.E., and Brown, J.R. Motor Speech Disorders. Philadelphia: W.B. Saunders Co., 1975.

Goodglass, H. and Kaplan, E. The Assessment of Aphasia and Related Disorders. Philadelphia: Lea and Febiger, 1972.

Halpern, H., Darley, F.L., and Brown, J.R. Differential language and neurologic characteristics in cerebral involvement. J. Speech Hearing Dis., 38, 162-173, 1973.

Winer, B.J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.

DISCUSSION

Q: What was the range of the Q-correlations?

A: Offhand I don't know. There were correlations which were low for both profiles. We simply used the higher correlation to classify the subjects.

Q: What tasks would you suggest to differentiate the two groups?

A: Tasks we routinely administer, such as naming, pointing to pictures, etc., do not differentiate very well. High level cognitive tasks and "nonlanguage" tasks involving visual perception would probably be more differentiating.

Q: Are the generalized intellectual impairment patients aphasic or are they something else . . . or are they "aphasia plus?"

A: Based on our data, the two groups look much the same. A major difference was that the aphasic subjects made more errors.

Q: Yes, but are they the same?

A: We don't think so, but based on the Q-correlations with the Halpern profile we weren't able to differentiate them.

Q: Patients who have generalized intellectual impairment are not aphasic. They don't sound the same, we don't treat them the same, and they don't improve like aphasic patients do. They aren't the same.

A: We don't disagree; however, we would feel more comfortable with a measure that yields empirical evidence to support our position.

Q: Sometimes I think we try to squeeze orange joice out of a rock when using an orange would be easier. The history and the medical data would differentiate these patients 100% of the time. The danger may be that we look too hard at the behavioral data and ignore the obvious.

A: Well, certainly you are right. As you say, and as we mentioned, our subjects could be discriminated by the nonlanguage data. Still, we think these patients are different and we hope to differentiate them on the basis of language.

Q: Do you have PICA's on these patients? If so, you could look for the BL (bilateral) signs and differentiate them that way.

A: We don't have PICA's on all of the patients.