

Dominant Functions of Right versus the Left Hemisphere

M. Mostafa, M. N. Kotby, M. Barakah, S. El-Sady, T. Allosh, A. Elshobary & M. Saleh

To cite this article: M. Mostafa, M. N. Kotby, M. Barakah, S. El-Sady, T. Allosh, A. Elshobary & M. Saleh (1989) Dominant Functions of Right versus the Left Hemisphere, *Acta Oto-Laryngologica*, 107:5-6, 479-484, DOI: [10.3109/00016488909127544](https://doi.org/10.3109/00016488909127544)

To link to this article: <http://dx.doi.org/10.3109/00016488909127544>



Published online: 08 Jul 2009.



Submit your article to this journal [↗](#)



Article views: 19



View related articles [↗](#)

Dominant Functions of Right versus the Left Hemisphere

M. MOSTAFA,¹ M. N. KOTBY,² M. BARAKAH,² S. EL-SADY,²
T. ALLOSH,¹ A. ELSHOBARY² and M. SALEH²

From the ¹Department of Neurology, and the ²Department of Otolaryngology, Unit of Phoniatics, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Mostafa M, Kotby MN, Barakah M, El-Sady S, Allosh T, Elshobary A, Saleh M. Dominant functions of right versus the left hemisphere. Acta Otolaryngol (Stockh) 1989; 107: 479–484.

The aim of this work was to study the function of the left and right cerebral hemispheres concerning linguistic, musical and cognitive abilities, through the evaluation of the deterioration of these domains following lesions of either hemisphere. The study was carried out on 80 subjects (60 ♂, 20 ♀) with a mean age of 48 years. Subjects were categorized into four groups, 20 in each. Group I had left brain lesion with dysphasia; group II, left brain lesion without dysphasia; group III, right brain lesion without dysphasia; group IV, control. Patient's evaluation included a dysphasia test, psychometric battery, tests for musical abilities, brain CT scanning and EEG. Group I showed deterioration in the linguistic abilities, while groups II and III had intact abilities. Deterioration in musical abilities was noticed in group III, with normal scores in groups I and II. There was deterioration of the intellectual abilities in all patients' groups, to varying degrees. The significance of the results is discussed. *Key words: cerebral organization of language, music in the brain, dysphasia.*

M. Nasser Kotby, 11 El-Ansary street, Manshiet El-Bakry, Cairo, Egypt.

In many respects cerebral specialized dominance constitutes a model problem in neurosciences (1). The study of functional deficits in unilateral cerebral lesions remains one of the means for investigating the organization of function in each hemisphere.

The aim of this work was to study the deficits resulting from either left or right brain lesions, utilizing a special battery of investigations in order to get a better understanding of the functions of each hemisphere, thus permitting a better insight into the diagnostic, therapeutic and prognostic problems of dysphasic patients.

MATERIAL AND METHODS

Sixty right-handed patients with cerebrovascular accidents were studied. They were classified into three groups each of 20 subjects:

Group I: 16 ♂, 4 ♀ with left cerebral lesions causing dysphasia (ages ranging 20–65 years; mean age, 43.5 years).

Group II: (17 ♂, 3 ♀) with left cerebral lesions not causing dysphasia (ages ranging 25–73 years; mean age, 51.4 years).

Group III: (15 ♂, 5 ♀) with right cerebral lesions not causing dysphasia (ages ranging 20–70 years; mean age, 47.4 years).

A fourth group (group IV) (12 ♂, 8 ♀) of normal subjects (ages ranging 20–70 years) was used as a control group. Mean age, 35.1 years.

Each subject went through a detailed schedule of data collection including: Patient interview and clinical examination, language test (2), musical test for simple rhythm discrimination and melody perception (3), a battery for non-verbal psychometric evaluation of cognitive and perceptual aptitudes (4, 5, 6, 7), and computerized tomography (CT)

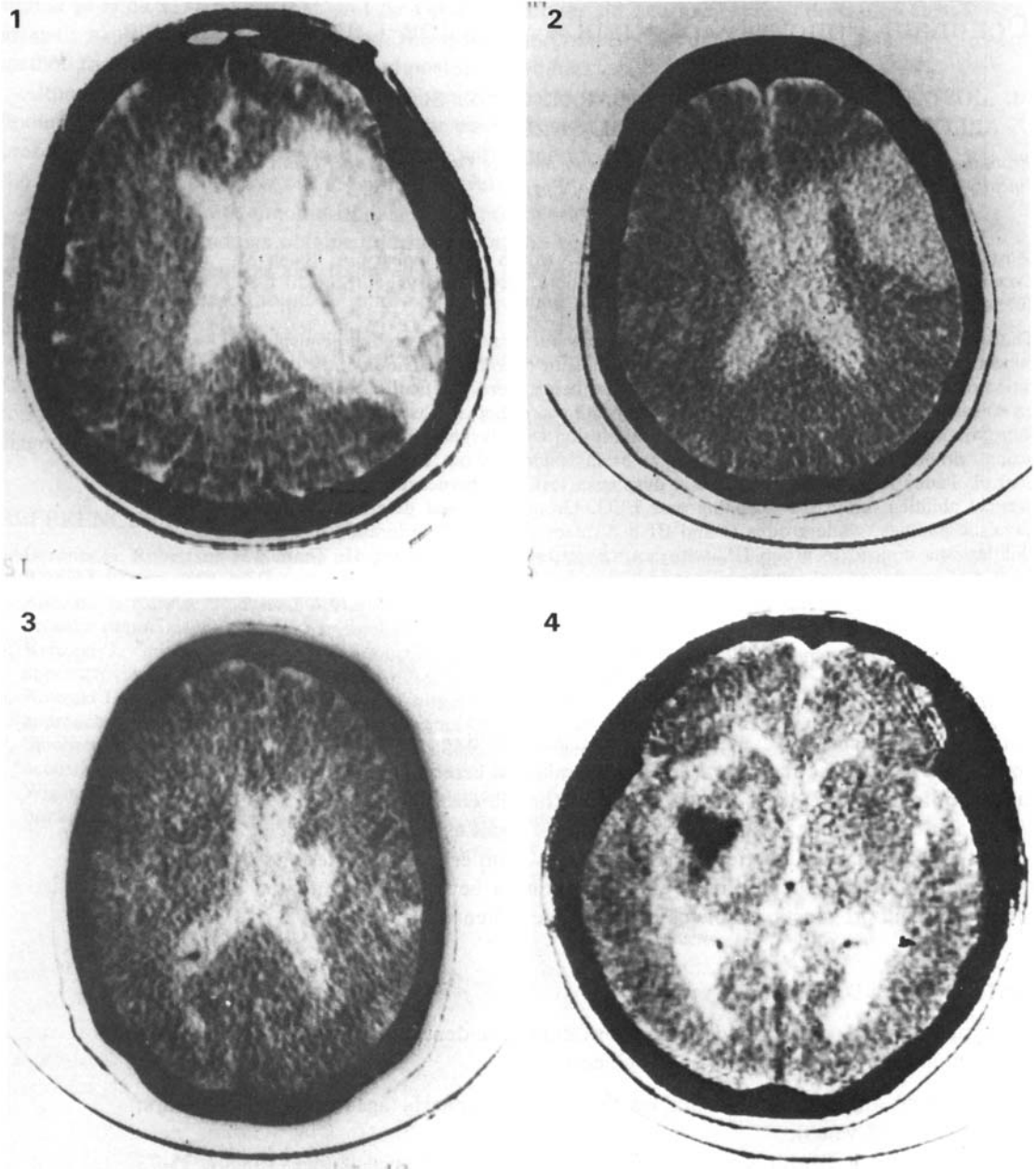


Fig. 1. CT without contrast, showing left extensive temporoparietal infarction. Male; 50 years. Language: predominantly expressive dysphasia. Musical abilities: slightly affected. Cognitive abilities: affected; below average.

Fig. 2. CT without contrast, showing left superficial parietal infarction. Female; 45 years. Language: predominantly expressive dysphasia. Musical abilities: slightly affected. Cognitive abilities: affected, mild degree.

Fig. 3. CT without contrast, showing left small periventricular infarction. Female; 41 years. Language: not affected. Musical abilities: slightly affected. Cognitive abilities: affected, severe degree.

Fig. 4. CT without contrast showing right diencephalic hematoma. Male; 38 years. Language: not affected. Musical abilities: severely affected. Cognitive abilities: not affected; average.

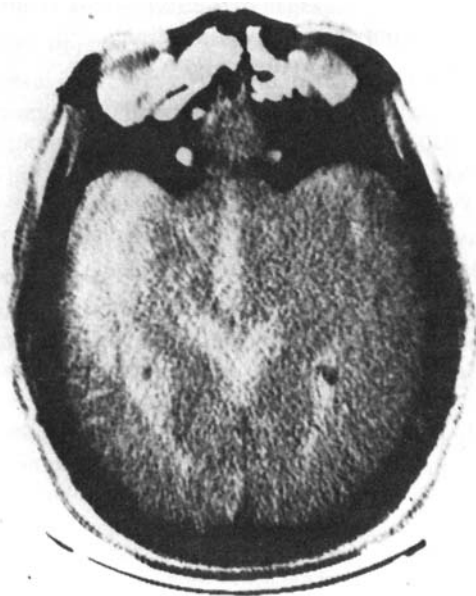


Fig. 5. CT without contrast, showing right extensive temporoparietal infarction. Male; 51 years. Language: not affected. Musical abilities: severely affected. Cognitive abilities: affected, mild degree.

(CGR CE 10000) of the brain. While the whole study was designed to compare the effect of left and right hemispherical lesions, the comparison of groups I and II is designed mainly to correlate left brain lesions to language deficits.

RESULTS

Associated Motoric Deficit

Right-sided hemiplegia was found in 17 cases (85%) in group I and 18 cases (90%) in group II. Left-sided hemiplegia was found in all cases of group III.

Language Evaluation

Affection of language function was restricted to group I only, while groups II and III had no significant language deficits, compared with the normal controls. There was a signifi-

Table I. Language function in different groups (% of scores)

Item	Group I		Group II		Group III		Group IV (control)	
	Mean score	SD	Mean score	SD	Mean score	SD	Mean score	SD
Expression	36	33.11	100	0	100	0	100	0
Impression	61	22.13	93	6.04	95	5.69	97	4.78
Reading	36	37.36	100	0	100	0	100	0
Writing	35	13.17	98	4.52	96	3.43	100	0
Calculation	52	39.47	90	6.46	95	3.98	100	0

SD = Standard deviation.

cant difference in the results between groups I and II, I and III (Table I). The differential affection of language domains in group I showed a 'predominantly expressive' impairment in 9 cases (45%), 'predominantly impressive' impairment in 2 cases (10%) and 9 cases (45%) have mixed expressive-impressive impairment.

Seashore Test for Musical Talents

There are significant differences between groups I and IV regarding loudness, rhythm and time, between groups II and IV in rhythm only, and between groups III and IV in all the 6 subtests except timbre. Timbre and tonal memory showed the lowest relative scores in all groups. Group III showed a special tendency to a stability of the low score figures in all members of this group. In the other groups there were, on the other hand, great intragroup variations (Table II).

Psychometric Aptitudes

There was a significant difference in the results of psychometry between all patient groups and the control group. The patient groups (I, II, III) fell within the range of mild cognitive and intellectual impairment. There was no significant difference in the results between the patient's groups. Intragroup variations of the results were minimal (Table III).

Table II. *Seashore test scores*

Item	Group I		Group II		Group III		Group IV	
	Mean score	SD	Mean score	SD	Mean score	SD	Mean score	SD
Pitch	13.5	14.85	12.8	20.27	4.4	4.70*	16.3	20.42
Loudness	4.8	7.40*	12.5	21.67	4.9	10.59*	19.1	19.23
Rhythm	4.3	7.14*	16.1	17.32*	2.3	4.05*	33.9	29.76
Time	11.7	20.76*	18.4	26.38	1.9	0.93*	27.5	27.79
Timbre	6.1	13.03	6.7	6.94	1.65	1.38	6.5	11.36
Tonal memory	2.1	2.98	6.5	9.23	1.10	0.44*	8.9	16.42

SD = Standard deviation. * Significant difference, $p < 0.05$. Patient groups were compared with control group, using Student's *t*-test.

Table III. *Psychometric evaluation scores*

Item	Group I		Group II		Group III		Group IV	
	Mean score	SD	Mean score	SD	Mean score	SD	Mean score	SD
Snijder-Ooman	55.4	17.5*	66.5	22.13*	57.0	16.54*	103.5	20.18
Progressive matrices of Raven	Mild degree of M.R.		Mild degree of M.R.		Mild degree of M.R.		Average intelligence	
Bender-Gestalt	Organic		Organic		Organic		Normal	
Marrienne-Frostig	60.8	19.79*	73.8	19.97*	68.4	14.39*	94.9	9.34

SD = Standard Deviation. M.R. = Mental retardation. * Significant difference, $p < 0.05$. Patient groups were compared with control group, using Student's *t*-test.

Results of Computerized Tomography (CT)

I. Type of lesion

Cerebral infarction was found in 18 cases in group I (90%), 13 cases (65%) in group II and 12 cases (60%) in group III. A hematoma was encountered in one case in group I (5%) and in another case in group III (5%). No pathological CT findings were found in one case (5%) in group I, 7 cases (35%) in group II and 7 cases (35%) in group III.

II. Site of the lesion

Superficial lesions are encountered with more than deep lesions in all groups (Table IV). *Language* is affected more frequently in superficial than in deep lesions. Impressive language is more affected in temporoparietal lesions, but expressive language is equally affected in both parietal and temporoparietal lesions. Left brain lesions, not causing dysphasia do not involve the temporal lobe. *Cognitive abilities* are affected more with superficial lesions but no correlation was found between the cognitive abilities and the extent of the lesion. No consistent relation was found between the site and extent of the lesion and the specific deficit in *musical abilities*.

DISCUSSION

Brain lesions result in a wide spectrum affection of patients' aptitudes, irrespective of the hemisphere affected. Language functions are affected more significantly in left hemisphere lesions. Expressive deficits are generally more frequent than impressive deficits. Normal language aptitudes in group II may be explained by the fact that the brain lesions may have been either deep-seated hemispherical, or brain stem lesions not affecting language and not shown in CT (35%). The rest (65%) have either small periventricular, small parietal, or occipital lesions. Lesions causing dysphasia on the other hand are significantly more superficial and more extensive than lesions not causing dysphasia. The presence of cognitive affection even in cases not showing any lesions in the CT in groups II and III may indicate that small, deep-seated lesions can cause a cognitive defect, such lesions when big enough may explain the pathogenesis of 'subcortical dementia'. Musical abilities are affected more significantly in right hemisphere lesions with a more consistent and wider range of affection, indicating that the right hemisphere may play a specific role in musical perception.

Table IV. CT findings (site of the lesion)

Site of the lesion	Group I	Group II	Group III
Superficial (cortical)			
1. Frontoparietal	–	1 (5%)	1 (5%)
2. Parietal	13 (65%)	6 (30%)	5 (25%)
3. Temporoparietal	3 (15%)	–	3 (15%)
4. Occipital	–	1 (5%)	–
Deep			
1. Periventricular	3 (15%)	4 (20%)	1 (5%)
2. Diencephalic (basal ganglia)	–	1 (5%)	3 (15%)
Free	1 (5%)	7 (35%)	7 (35%)

REFERENCES

1. Harnad S, Doty RW. Introductory overview. In: Harnad S, Doty RW, Goldstein L, Jynes J, Krauthame G, eds. *Lateralization in the nervous system*. New York: Academic Press, 1977.
2. Kotby MN, Moustafa M, El Banouby MH, Barakah M. A modified scoring system for testing language disability in dysphasic patients. *HNO Praxis (Leipzig)* 1981; 6: 194–8.
3. Seashore L, Lewis D, Saetveit JG. *Revision of the seashore measures of musical talents*. The Psychological Corporation, 304 East 45th Street, New York: 1960.
4. Snijders JTh, Snijders ON. *Non-verbal intelligence test for deaf and hearing subjects*, 4th edition. Groningen: Walters Noordhoft NV, 1970.
5. Raven JC. *Guide to using the coloured progressive matrices*. London: AK Lewis, 1960.
6. Frostig M, Lefever W, Whittlesey G. *Administration and scoring manual for development test of visual perception*. Palo Alto: Consulting Psychologists Press, 1966.
7. Bender, L. *Motor Gestalt test*. American Orthopsychiatric Association, 1946.