

Sex Differences in Intrahemispheric Language Organization

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Introduction

Sex differences in cerebral organization is a controversial topic. A remarkable number of studies has been performed in healthy men and women to explain apparent dissimilarities of brain functions like visuospatial or verbal skills. McGLONE (1977) examined the cerebral organization of speech and language functions in neurological cases, finding a striking difference in the incidence of aphasia. In her population three times more men than women with left hemisphere lesions were classified as aphasics. Thus, a greater degree of functional brain asymmetry in males and a more bilateral cerebral speech representation in females was hypothesized. In her study (1983) KIMURA found that speech and language disorders and manual apraxia occurred in women more often from damage to the anterior part of the left hemisphere than from posterior damage. From this and subsequent data (KIMURA and HARSHMAN, 1984) a differential organization of speech and language functions within the left hemisphere was concluded. In females, language appeared to be critically dependent on the left anterior region, whereas in males both the anterior and the posterior parts of the dominant hemisphere seemed to be crucial for intact language functions. There are several limitations to these studies. Lesion localization was only based on EEG and clinical data in many instances. Also, sample size was rather small and there were no radiological criteria given for what is anterior or posterior. Therefore, in our investigation we attempted to provide more detailed information on intrahemispheric language organization by reviewing the aphasia in left-hemisphere damaged patients.

Methods

185 patients were selected on the basis of a single left hemisphere lesion (CT) and on an aphasia examination (Western Aphasia Battery, WAB, or extensive bedside testing). A total of 159 aphasic patients, 89 males and 70 females, and 26 nonaphasics (12 males, 14 females) were included. Etiologies were ischemic infarcts, cerebral hemorrhages and tumors. CT scans were reviewed by a neurologist. Anterior and posterior region were separated by a line drawn from the Central Sulcus to the Genu of the Internal Capsule (see Figures 1 and 2). The Matsui/Hirano atlas was used to identify the relevant structures.

Results

Aphasia classification by the WAB was performed in 135 patients. The resulting subgroups were: Anomics = 37 (20 M, 17 F), Global aphasics = 29 (14 M, 15 F), Broca's = 27 (16 M, 11 F), Wernicke's = 23 (16 M, 7 F), Conduction aphasia = 12 (5 M, 7 F), TCS = 5 (3 M, 2 F), TCM = 1 (M), and Isolation aphasia = 1 (M). Aphasia classification based on clinical judgement revealed 13 pa-

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tients with predominantly expressive aphasia (7 M, 6 F), 4 with receptive aphasia (2 M, 2 F), and 7 anomics (5 M, 2 F).

No significant sex differences were found in the total aphasic population (Table 1) or in any of the aphasic subgroups on a chi square test. Also, left hemisphere lesions without aphasia are quite evenly distributed (Table 2). The results were also calculated by excluding the central group, counting merely the predominantly anterior and posterior lesions, but no significant differences were reached by this method either.

Looking at subgroups such as the Broca's and Global's aphasics an equally large number of cases had anterior and posterior extension of the lesion in both, the male and the female group. Wernicke's, Anomics and Conduction aphasics had mostly posterior lesions, and there was no significant sex difference in their distribution.

Discussion

Our results suggest no significant sex differences in the intrahemispheric organization of language functions, based on the incidence of left hemisphere lesions and aphasia. Particularly, there is no convincing evidence from our lesion study to indicate that the anterior region in females subserves functions that are carried out by posterior areas in males.

Despite careful assessment procedures and the use of objective neuroimaging data, several caveats remain to be mentioned. Handedness, an important factor in cerebral lateralization was not documented sufficiently in all patients. Differentiating old from new infarcts, or tumor tissue from adjacent brain edema is sometimes difficult on CT slides. Also, even a cautious evaluation of CT scans cannot exclude patients with diffuse brain lesions reliably. Moreover, factors influencing aphasia like etiology and age have not been controlled in this study in order to gain a large population.

However, there remains substantial evidence against a concept of simple intrahemispheric sex difference in our study. Cerebral organization in men and women is complex and multifactorial: it is produced by interrelated, anatomical, physiological, endocrine and acquired psychological differences. It is unlikely that a simplistic anterior-posterior dissociation will account for the subtle but significant differences in the cognitive performance of males and females.

References

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 Kimura, D. and R A Harshman (1984); Sex differences in brain organization for verbal and non-verbal functions. In: De Vries et al. (eds.); Progress in Brain Research, Vol. 61. 423-439.

	Males		Females	
	18	A	15	$\chi^2 = 1.4835$
	27	C	21	df = 2
	44	P	34	P = 0.5
Total	89		70	

Table 1
Patients with aphasia

Males		Females	
3	A	3	$\chi^2 = 0.8511$ df = 2 P = 0.7
1	C	3	
8	P	8	
Total	12	14	

Table 2
Patients without aphasia

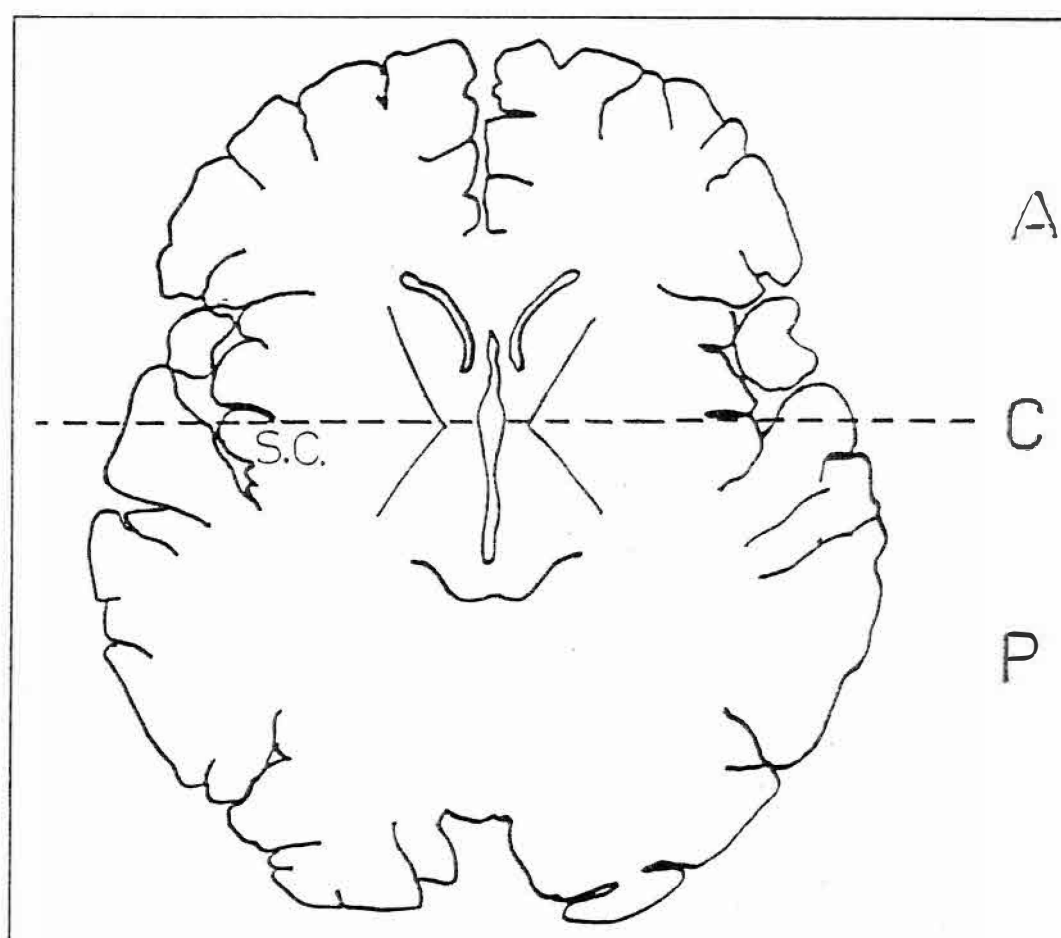


Figure 1
(A = anterior, C = central, P = posterior, S.C. = central sulcus)

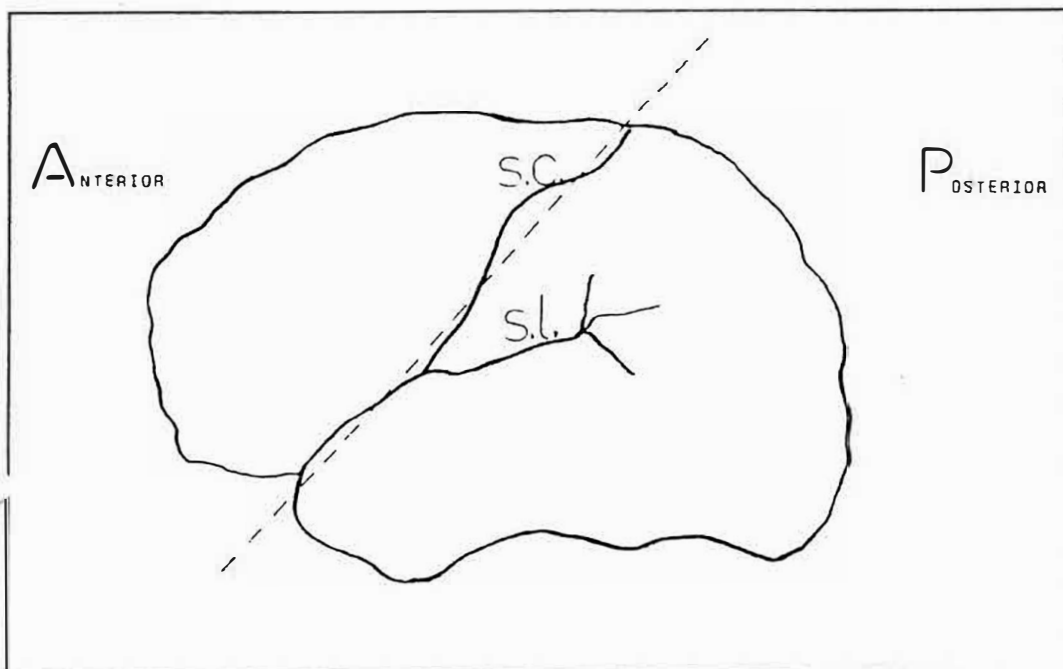


Figure 2
(S.C. = central sulcus, S.L. = lateral sulcus)

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Depression After Stroke, Some Nosological Considerations

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Many clinicians have recognized the occurrence of depression following stroke (1-13). A review of the literature (14) indicates that depression is the most commonly reported emotional disorder post-stroke. In most studies of depression in stroke patients the lesions have been located in the left hemisphere (6, 9, 15) and consequently depression has often been described as co-occurring with aphasia (9, 16-23). The conclusions drawn from these studies frequently suggest that the altered mood is a psychological reaction to either or both the impaired language function and the physical handicap (24-26). In the literature, however, there are several findings which contradict this assumption. Such studies outline a different etiology for depression following lesions in the dominant hemisphere.

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