

TOPOGRAPHY OF THE HEMI-INATTENTION SYNDROME

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The hemi-inattention syndrome was studied in 15 right-handed adults, 12 men and 3 women. One patient had a pontic-mesencephalic lesion, 3 had right hemisphere damage, 7 had left-hemisphere lesion and 4 had bilateral lesions. All lesions were confirmed by CT-scan. Different criteria of hemi-inattention were used. All patients presented extinction, inattention and in 13 visuomotor akinesia; 5 of the left and all of the right and bilateral lesion patients presented spatial neglect. CT-scans were superimposed. The posterior parietal region was the most important in producing contralateral hemi-inattention. Results are discussed with relation to the literature and the educational factor and cerebral asymmetry are discussed with regard to hemi-inattention.

Hemi-inattention has been defined as a failure to respond or direct attention toward stimuli presented to the side contralateral to a cerebral lesion, not explainable by sensory or motor defects (Friedland & Weinstein, 1977). It can be observed by sensory extinction to simultaneous stimulation, hemispacial neglect, hemiakinesia, and allesthesia (Heilman *et al.*, 1983). Anosognosia and eventually somatoparaphrenia are associated syndromes.

The term "inattention" was first used by Poppelreuter in 1917. However, Hughlings Jackson had described a patient in 1876 that "inattended" the left side of a text when reading. The necropsy findings of this patient showed a right temporo-posterior glioma. At the end of the nineteenth century von Monakov and Anton noticed that some patients with cortical lesions were not aware of their defects. In 1914, Babinski reported that the lack of awareness or anosognosia was more frequently found in right side hemispheric lesions. But only in 1941 Brain related hemispacial neglect with right hemispheric lesions. Since then, many researchers have analyzed the hemi-inattention syndrome, and several levels of damage have been proposed.

Sensory extinction (for visual, tactile and auditory stimuli) refers to the absence of response to the stimulus contralateral to a cerebral lesion, when two simultaneous stimuli are bilaterally presented. Allesthesia is the displacement of a sensation, when a stimulus applied to one side of the body is felt on the other side of the body, usually in a homologous region. Spatial neglect occurs when stimuli contralateral to a lesion are ignored; for example, half of a figure is drawn; drawings and letters are concentrated one side of the paper; half of a word is copied; when reading, the patient omits letters presented in one side of the text. Hemi-akinesia is the subutilization of the hemibody contralateral to a cerebral lesion, when no motor alteration is present; the patient does not use one side of his body and does not orient his eyes or his head spontaneously toward the contralateral stimulus. In hemiasomatognosia the patient ignores one side of his body during daily activities (shaves half his face, combs only half his head, or covers half his body). Anosognosia is the lack of awareness of one's

disease, and can occur to the point of rejection and unawareness of some parts of the body with delirious ideas (somatoparaphrenia); for example, the patient says his hand belongs to another person.

Classically, hemi-inattention has been described as a result of right parietal lesions (Hecaen & Albert, 1978), although it has been described in frontal (Heilman & Valenstein, 1972; Heilman *et al.*, 1983), limbic (Watson *et al.*, 1973), thalamic (Watson & Heilman, 1979; Vilkki, 1984) and mesencephalic lesions (Watson *et al.*, 1974). However, in the latter, hemi-akinesia has been reported only in animals.

Usually, hemi-inattention has been related to right hemisphere damage (Weinstein & Friedland, 1977). Nevertheless, some cases of left hemisphere lesions producing hemi-inattention have been described (Battersby *et al.*, 1956; Hécaen, 1969; Heilman & Watson, 1977; Ardila, 1983); these cases are less frequent, less severe and have a faster evolution.

The goal of the present research was to study the hemi-inattention syndrome in a sample of 15 patients, describing the topography of the responsible lesions, based on CT-scan information.

METHOD

Subjects. Hemi-inattention syndrome was studied in a sample of 15 right-handed patients, 12 men and 3 women, with a age range between 25 and 72 years, and with an average of 3rd grade education, excepting one at the university level. One patient had a pontic-mesencephalic lesion, 7 had a left hemispheric lesion, 3 had right side lesions, and 4 bilateral lesions (2 with right side predominant lesion, 1 left side predominant, and 1 whose predominance was unclear). The etiologies of the lesions were: 13 of vascular origin (6 hemorrhagic, 6 ischemic, and 1 caused by lupic arteritis) and tumoral disease in the other 2 patients (1 bilateral frontal glioma, and 1 left parietooccipital meningioma). All the lesions were confirmed by CT-scan.

Instruments. A complete neurologic examination as well as a neuropsychological study which included a hemi-inattention assessment were employed.

Four hemi-inattention criteria were used: (1) Extinction with double simultaneous stimulation: (a) visual, (b) tactile, (c) auditory. (2) Hemi-akinesia: (a) motor, (b) visuo-motor; (3) hemispacial neglect: (a) bisection of a line, (b) drawing of a house, a daisy, and proper placing of the numbers on a clock and (4) Hemi-asomatognosia: no recognition of parts of the body as his or hers. Figure 1 illustrates right and left neglect in placing the numbers on a clock.

Six standard CT-scan cuts for each patient were transposed on the standard template. Afterwards, images for different patients were super-imposed. This procedure made possible the recognition of the critical superposition areas responsible for the appearance of the hemi-inattention syndrome.

RESULTS

Table II shows the general results. All the patients presented extinction with double simultaneous stimulation. Hemi-akinesia was observed in 13 of the 15 patients. Spatial neglect was observed in all the patients with right hemisphere damage and in 5 of 7 patients with left lesions. Hemi-asomatognosia was present in 8 of the patients,

TABLE I
 Characteristics of the patients with hemi-inattention

No.	Age	Sex	Education	Site	Etiology	Duration	Associated syndromes
1	58	M	3 years	P-O right	CVA Ocl.	90 days	Apraxia, Agnosia, Hipostesia
2	50	M	2 years	P-O right	CVA Ocl.	2 days	Apraxia
3	63	M	2 years	P-O-T right	CVA Hem.	90 days	Apraxia, Hemiparesis
4	51	M	17 years	P. Mes. right	CVA Hem.	4 days	Hemiparesis
5	51	M	3 years	P-O-T right	CVA Ocl.	8 days	Agnosia
6	55	M	5 years	O-T left	CVA Ocl.	12 days	Aphasia, Hemianopia
7	28	M	3 years	P-T left Thzl.	CVA Hem.	5 days	Aphasia, Hemiparesis
8	52	M	2 years	P-O left	CVA Hem.	10 days	Aphasia
9	54	M	illiterate	Par. left	CVA Hem.	10 days	Aphasia
10	56	F	3 years	P-O left	CVA Hem.	5 days	S. Balint
11	56	F	illiterate	F-bil.	tumor	90 days	Frontal syndrome
12	72	M	2 years	O-T bil.	CVA Ocl.	90 days	S. Parietal, Hemianopia
13	69	M	1 year	O-T bil.	CVA Ocl.	90 days	Aphasia
14	23	F	5 years	Bil. diff.	lupus	8 days	Aphasia
15	60	M	4 years	Occ. left	tumor	90 days	Aphasia, Agnosia, R. hemiparesis

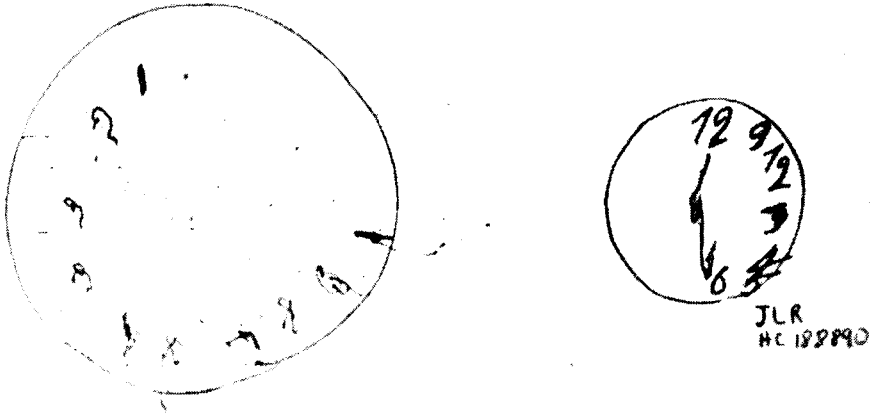


FIGURE 1 Placing the numbers on a clock in case of left and right neglect.

TABLE II
Characteristics of the hemi-inattention syndrome

No.	Site		Extinction			Hemi-akinesia		Spatial neglect	Hemi-asomatognosia
			V	A	T	M	VM		
1	P-O	right	X	X		X	X	X	
2	P-O	right	X	X			X		
3	P-T-O	right	X	X			X	X	
4	Ponto-mesencephalic		X				X	X	
5	T-P-O	left	X	X	X	X	X	X	
6	T-O	left		X		X	X	X	
7	P-T Thalamic	left	X	X			X	X	
8	P-O	left	X	X	X	X	X		
9	Par.	left	X		X	X	X		
10	P-O	left	X	X	X	X	X		
11	F bil.	(right)	X	X	X	X	X		
12	P-O bil.	(right)		X	X	X	X	X	
13	T-O bil.	(left)	X	X	X	X	X		
14	Diffuse	—	X	X	X		X		
15	Occ.	left	X			X	X	X	

V = visual, A = auditory, T = tactile, M = motor, VM = visuomotor.

The patient with ponto-mesencephalic damage presented a severe left side gazing akinesia with anosognosia and constructional difficulties.

The CT-scan superposition showed the existence of critical brain regions in the appearance of the hemi-inattention syndrome. Damage in parieto-temporo-occipital areas was seen in 12 cases, including left and right lesions.

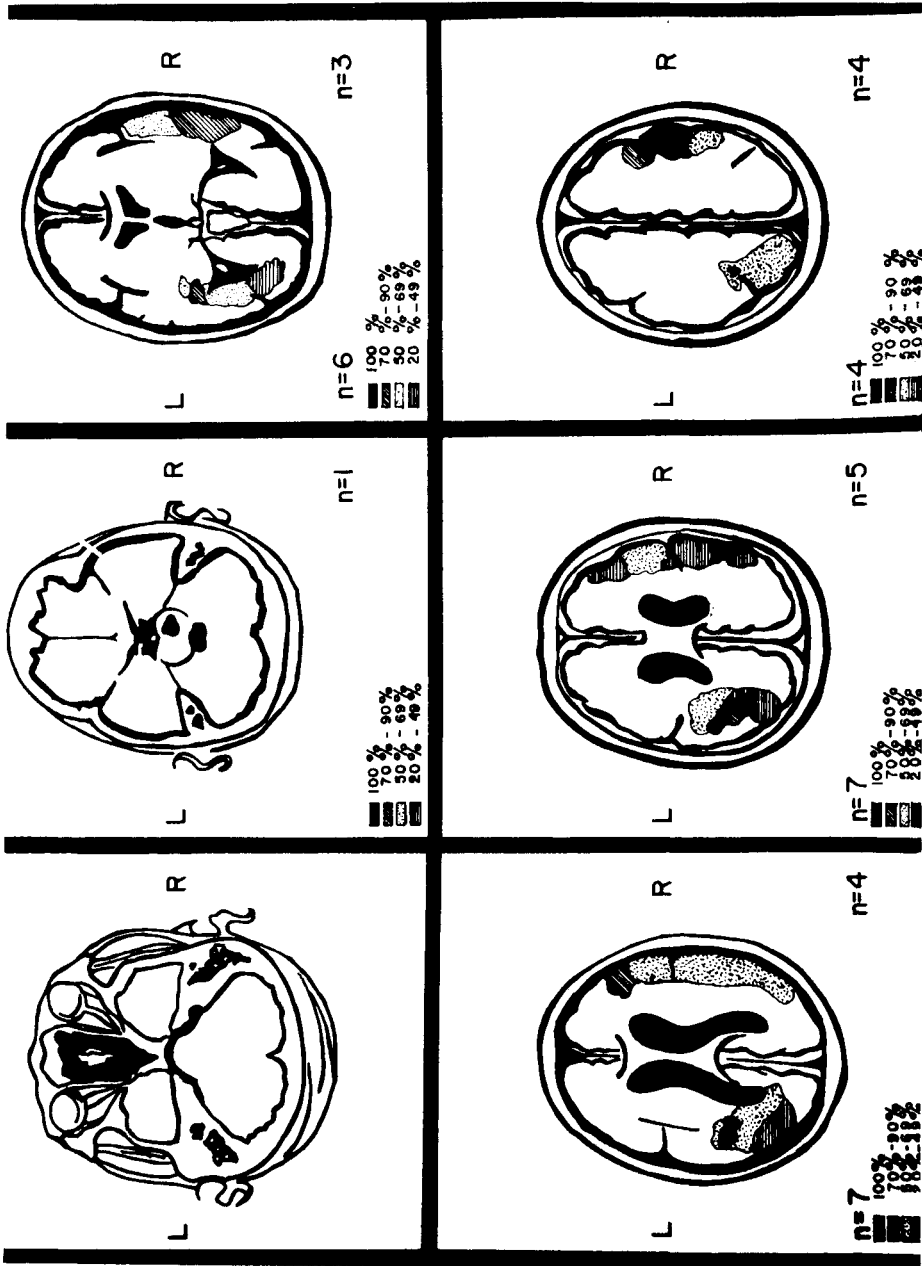


FIGURE 2 Six standard CT-scan cuts. Superposition zones are shown at each level, number of patients included, and percentage of patients. At the second level the site of damage appears for the patient with ponto-mesencephalic lesion. At the fifth cut two patients were excluded (thalamic and bifrontal lesions). Highest superposition was found at the fifth level.

DISCUSSION

Several points deserve special attention in our results.

First of all, it is quite surprising to find the great proportion of patients with left side lesions found in our sample. The relative frequency of hemi-inattention as a result of right or left side lesions vary in the reports of the different authors, depending on the variables considered and the criteria used to define hemi-inattention. Thus, Hécaen (1969), in a series of 59 cases, reported 51 patients with right side lesions, 4 left, and 4 bilateral. Of the 4 patients with right hemi-inattention (left injury) 3 were left-handed. In a more recent study (Hécaen, 1972) found that in 179 patients with right damage, 56 presented hemi-inattention; and it was present in only one case out in 286 patients with left lesion. Weinstein and Cole (1963), (cited in Friedland & Weinstein, 1977) point out a relative frequency of 7 to 1 (right lesion to left lesions). Korchazhinskaya and Popova (1977) observed in a right handed and left-contrariated handed (those who use the right hand only for handwriting) sample, with left injuries, characteristics of hemi-inattention in 20% of the cases. Battersby *et al.* (1956) found a frequency of right to left injuries in cases of unilateral neglect of 80% and 20% respectively; they believed that these percentages tend to equalize when the communication difficulties of the latter group are controlled. Heilman and Watson (1977), in a group of 23 cases of hemi-inattention, found 20 with right lesions and only 3 with left lesions.

With the exception of Hécaen's report (1972), all the studies with extensive populations have ignored the left handedness factor, familial left handedness or left contrariated handedness. Ardila (1983) studied one case of right hemi-inattention in a strongly left handed patient, a member of a family in which practically all were left handed. Korchazhinskaya and Popova (1977) noticed that among their patients are included subjects that use only their right hand for writing. And finally, we note the variability in the cerebral organization of verbal and visuo spatial functions.

Our sample presents a fundamental difference when compared with the other populations analyzed by the authors mentioned: It is a sample of illiterates or semi-illiterates. Very probably, this is the basic factor that makes us find an extremely high proportion of patients with hemi-inattention as a result of left-hemisphere lesions. It is believed that in illiterates the lack of stimulation of the right hand, the absence of experience with written linguistic expression and the nonutilization of the visual channel in linguistic behavior, could influence the cerebral organization of the linguistic functions (Matute, 1984). Several studies point out that aphasia is not only less severe, but also infrequent in cases of left injury in illiterate samples, and on the contrary, losses in language are due to right side lesions with a higher frequency (Critchley, 1956; Eisenson, 1964; Gorlitzer von Mundy, 1959; Cameron, Currier & Haerer, 1971; Matute, in press). It is known that cerebral lateralization in language correlates with the educational level of the subject (De Obaldía & Gomez, 1975; Borowy & Goebel, 1976). We believe that our results represent the counterpart for the visuo-spatial functions and attentional processes of the results found by other authors for the cases of aphasia found in illiterate populations. Nevertheless, we should give special emphasis, that with this condition, hemi-inattention is notoriously less severe and has a faster evolution in cases of left injury, a fact that coincides with other reports (Albert, 1973; Heilman, 1983).

Neglect, as a consequence of mesencephalic lesions has been reported only in cats and monkeys (Watson *et al.*, 1974) and has been not described in humans (Heilman,

1983). We found the syndrome in a patient with ponto-mesencephalic lesion without any apparent cortical damage.

Mesulam (1984) proposes an attentional system in which reticular, thalamic, frontal and parietal structures interact. Lesions in any of these levels would alter the control of attention. In animals, the alteration would be almost the same either with right or left lesions. In humans, the right hemisphere, as a consequence of language acquisition, would appear to specialize in the knowledge of space and the spatial environment surrounding (Ardila & Ostrosky, 1984).

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