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CT Changes Associated with Migraine

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In order to determine further the correlation between severe migraine and cerebral atrophy, a group of patients attending either the Charing Cross Hospital migraine clinic or outpatient clinics at the National Hospital, Queen Square, was investigated by computed tomography. The results confirm an association between atrophy and migraine of more than 5 years duration, probably more severe in men than women. The most striking changes were seen in those men who suffered from attacks lasting less than 6 hr.

Two previous reports from authors of this paper have suggested an association between severe migraine and computed tomographic (CT) appearances considered to represent cerebral atrophy [1, 2]. Neither of these studies was "blind," in that patient histories were known to the observers interpreting the CT pictures, and correlations between individual clinical features and CT findings were scarcely attempted. The present study, a continuation of the last reported, is an attempt to confirm the finding of cerebral atrophy, to extend the comparison between "normal subjects" and migraine sufferers from women to men, and to try to discover risk factors in the association. In addition to atrophy, parenchymal edema and infarction have been reported as CT findings in migraine [3–11], but we are not concerned with these in the present series.

Subjects and Methods

Our series consisted of 53 patients (24 men and 29 women), each of whom had suffered for at least 5 years with classical or common migraine, as described by Valquist criteria [12]. All were either attending the Princess Margaret Migraine Clinic at Charing Cross Hospital or outpatient clinics at The National Hospital, Queen Square. No patient with overt signs or symptoms of neurologic disease was included.

All the patient histories were withheld from the CT scan readers (G. H. du B., J. S. R., and J. M. S.) until the scans had been measured and reported. The histories obtained included information about frequency and length of attacks; drug treatment; and the severity of headache, graded in one of four levels (absent or negligible, mild, moderate, or severe), unless too variable to be graded.

In order to maintain the comparison with the normal series of Gyldensted and Kosteljanetz [13], all CT examinations were performed on an EMI 1010 scanner using 13 mm cuts parallel to the orbitomeatal line. Images were recorded at window width of 40, center 18 EMI units, using a multiformat imager with the minification factor at 4.54.

Subjective assessment of the width of the subarachnoid space, made by the three observers, was graded on a scale of 0–3. Measurements to the nearest 0.5 mm were made with a transparent ruler of the width of the anterior horns, the septum caudate distance, the cella media distance, the third ventricular width, and the cella media, as defined by Gyldensted [14]. The bifrontal cerebroventricular index (CV index 1) and the bicaudate cerebroventricular index (CV index 2) were measured by the technique of Hahn and Rim [15]. Evans ratio was measured according to the original description [16], and the largest cerebral sulci were measured as by Gyldensted and Kosteljanetz [17]. Measurement of the posterior fossa structures, including ratios for the superior cerebellar cistern, fourth ventricle, and cistern/brainstem ratio were obtained by the method of Koller et al. [18].

Results

We present correlations between measurements made on CT, particularly those of cerebral sulci and ventricles, and duration and severity of symptoms, gender, age, and some other clinical features, including drug history.

Age range of patients was 12–71 years, mean 41.4 years. Comparison was made using the Student *t*-test, employing the means and standard deviations of measured values in the published normal series. The results are shown in tables 1 and 2. The findings we wish to draw attention to are: (1) the ventricles of male migraine sufferers were larger than normals of the same ages ($p = 0.0361$); (2) larger ventricles were found in those patients whose attacks were of shorter duration (under 6 hr) ($p = 0.0125$); (3) larger than normal cerebral sulci were found in males ($p = 0.0034$) and in patients who had attacks of shorter duration (under 6 hr) ($p = 0.06$ NS); and (4) larger cerebral sulci were also found in patients being treated with propranolol ($p = 0.0268$) and in patients on ergotamine ($p = 0.0295$).

There were no significant associations between severity or location of headache, complicating features, age, time of onset of attacks, hypertension, nausea, vomiting, or handedness and any CT measurements, and there was no statistical association between widening of the lateral or third ventricles and the severity or duration of migraine. Severe atrophy was found in five patients, and changes that might indicate mild atrophy in another 31.

Discussion

Our previous study [2] was largely of women; the present work indicates that the evidence of cerebral atrophy is more prevalent in men. But because of the influence of self-selection upon our sub-

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TABLE 1: **General CT Findings in Migraine Patients**

Type of Migraine	No. Migraines					
	Totals	Normal	Atrophy		Infarct	Other
			General	Focal		
Common	29	9	18	2	1	1
Classical	24	8	13	3	3	2

TABLE 2: **Detailed CT Findings in 53 Migraine Patients**

Finding	No. Cases
Asymmetric lateral ventricles	12
Widening of sylvian fissure	11
Significantly larger:	
Lateral ventricles	10
Cerebral sulci	29
Interhemispheric fissure	1
Focal atrophy	5
Cerebral sulci:	
Grade 0	17
Grade 1	1
Grade 2	25
Grade 3	10
Cerebral atrophy:	
Absent	17
Mild	31
Severe	5

jects (patients entering the study were those who were willing to have a CT examination) our findings cannot be trusted to determine the actual prevalence of atrophy in migraine sufferers. They do, however, point strongly to an association between migraine of more than 5 years duration and atrophy, if that is indicated by the larger than normal lateral ventricles and cerebral sulci. Why the CT changes in the lateral ventricles are more significantly associated with migraine attacks of short duration is completely unknown at this time.

The only current drugs for which we could detect an association in CT presentation were propranolol and ergotamine. Cerebral sulcal widening was linked to both. The evidence for the propranolol contribution to the link was less strong, however, because of doubts about the frequency with which propranolol-treated patients had had ergotamine in the past.

The possibility that our findings may be influenced by undetected variation in the minification factor of our CT scans was considered, but this seems an improbable explanation. The indices we used are not magnification-dependent, and they were also abnormal. Also, the abnormalities were confined to the lateral ventricles and cerebral sulci. Other measurements, including all those in the posterior fossa, were within normal limits.

Our work to date continues to suggest that common and classical migraine of more than 5 years duration is associated in both men and women with evidence of widening of the lateral ventricles and of one or more cerebral sulci, in addition to the occasional demonstration of frank infarcts. We have found no association between CT changes and age or the total migraine history, other than the single imposed condition that migraine had been present for at least 5 years.

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