Abstract.—Objective. To assess the status of cerebral perfusion in patients with eating disorders (ED) in the acute phase of the disease.

Materials and methods. Seventeen patients, with a mean age of 22 years, diagnosed with ED according to DSM-III-R (Diagnostic and Statistical Manual of Mental Disorders) criteria and under close clinical monitoring were studied in the initial acute phase of their disease. Brain SPECT with 15 mCi of Tc99m HMPAO was performed on all patients and assessed using visual and semi-quantitative analysis. The latter was carried out by obtaining left/right indices in sixteen symmetrical 5 × 5 pixel regions of interest (ROI) in three transverse slices, one below the cantho-meatal line and two above, at 2 and 5 cm, respectively.

Results. Visual analysis showed hypoperfusion of the anteroinferior region of the left temporal lobe in 7/17 patients, and in the homonymous region of the right temporal lobe in 1/17. Semi-quantitative analysis did not show statistically significant differences in the slices above the cantho-meatal line when the means of the asymmetry indices were compared between the anterior (frontal), middle (temporal and parietal) and posterior (occipital) regions of each slice, obtaining values ranging between 0.99 ± 0.05 and 1.02 ± 0.03. However, in the lowest slice, the anterior (temporal) region showed a mean asymmetry value of 0.89 ± 0.15, and on comparing it with the mean of the asymmetry indices of the posterior region (cerebellum), it showed a statistically significant difference (p < 0.05).

Conclusion. Patients with ED frequently show hypoperfusion of the anteroinferior region of the temporal lobe, predominantly in the left hemisphere, in the acute phase of the illness.

KEY WORDS: single photon emission computed tomography, regional cerebral perfusion, eating disorder.
INTRODUCTION

Recent years have witnessed a growing interest in eating disorders (ED), as reflected in the number of published studies that have this pathology as an objective.1-3 However, they continue to be diseases of unknown origin which usually commence in adolescence, mainly in females.

The inaccessibility of the central nervous system has made their in vivo study difficult. In the last decade, the development of different neuroimaging techniques has offered the possibility of learning more about the complex neuronal function and its biological basis, both through techniques which provide eminently morphological information (computerized axial tomography [CAT], nuclear magnetic resonance [NMR]) and by means of those which are essentially functional (single photon emission computed tomography [SPECT] and positron emission tomography [PET]) with perfusion and metabolic radiotracers. In this respect, brain perfusion SPECT is recognised as a useful and reliable technique for the study of pathologies that present with alterations in cerebral blood flow;4-6 for this reason, we consider that its application in patients with ED could be of interest. The precocity of the functional changes in relation to the structural changes also gives these types of examinations special importance.

Even though there are very recent research lines on neurotransmission in these patients,7 we consider that all contributions on the state of their brain function may aid its overall comprehension. In this respect, the results provided in this study are centred on the state of cerebral perfusion in the acute phase of the disease and may useful in reaching this global objective.

MATERIALS AND METHODS

We studied 17 patients with ED in accordance with DSM-III-R (Diagnostic and Statistical Manual of Mental Disorders) criteria, 16 females and 1 male; mean age was 22 years, ranging from 11 to 37 years. The diagnosis was anorexia nervosa in 13 patients, bulimia in 3 and a mixed pattern was established in 1. The body mass index varied between 13 and 19.5 in the females. At the time of performing the Tc99m-hexamethyl propylene amine oxime (HMPAO) SPECT, the patients were under close clinical monitoring for a first episode of the disease or worsening of a recent first episode.

Tc99m-HMPAO SPECT was performed 10 minutes after the intravenous administration of 15 mCi of Tc99m-HMPAO, using a Siemens Orbiter gamma camera equipped with a Neurofocal astigmatic collimator and acquiring 64 projections onto a 64 × 64 matrix with pixel size 6.6 mm (FWHM over 8-10 mm). At least 200,000 counts were acquired per projection. The Tc99m-HMPAO labelling efficiency was assessed by radiochromatography; the lipid soluble fraction was greater than 95% in all cases. The images were reconstructed by filtered back-projection using a ramp filter with Nyquist frequency 1, reorienting the study according to a fronto-occipital axis parallel to the intercommissural line.

The studies were evaluated by consensus between 3 Nuclear Medicine specialists by visual analysis and semi-quantitively by comparing left/right asymmetry images obtained from sixteen 5 × 5 pixel symmetrical cortical regions of interest (ROI) in 3 selected transverse tomographic slices of 2 pixel thickness, one 2.5 cm below the canthomeatal line (N1) and the other two above, at 2 and 5 cm, respectively (N2 and N3) (fig. 1). To perform the semi-quantitative analysis, the mean of the left/right asymmetry indices was compared in each slice of the anterior (frontal in N2 and N3 and temporal in N1), middle (parietal in N2 and N3) and posterior (cerebellum in N1 and occipital in N2 and N3) regions. The Mann-Whitney U test was used to assess the statistical significance.

RESULTS

Visual analysis of the studies showed the existence of hypoperfusion of the temporal lobe in 8/17 patients; this was localised in the anteroinferior region of the left temporal lobe in 7 patients and in the homonymous region of the right temporal lobe in 1 patient (table 1).

![FIG. 1.—Example of the tomographic slices selected and the localisation of the regions of interest used.](image-url)
The left/right asymmetry indices are shown in detail in Table 2. The mean values of these indices in levels N2 and N3 varied between 0.99 ± 0.05 and 1.02 ± 0.03; no statistically significant differences were found between the mean asymmetry indices of the different regions of each slice in the two upper levels when they were compared. However, the mean of the left/right asymmetry indices of the anterior region of N1 (temporal) was 0.89 ± 0.15; comparison with the posterior region (cerebellum) of the same slice showed a statistically significant difference (p < 0.05). When the mean of the asymmetry indices of the inferior temporal region was compared with that of a healthy control population of similar age, it also showed a statistically significant difference (p < 0.05) (Table 3).

**DISCUSSION**

Recent years have witnessed a growing interest in eating disorders in the young and adolescent population, which is reflected in the number of scientific studies published that have this pathology as an objective. However, they continue to be diseases of unknown origin which invariably commence in adolescence, usually around puberty in girls while there are signs of an earlier start in male patients. Knowledge of the neurobiological basis of ED is a topic of incessant investigation. Thus, over the years, abnormalities in metabolism and cerebral perfusion have been found in these patients, both in the subcortical structures and in the cerebral cortex. One of the first approaches to the problem described an asymmetric metabolism in the cerebral basal...
ganglia, while other researchers found hypoperfusion in the cerebral frontal, parietal and temporal cortex. From another point of view, a brain activation study using images of food found a different activation response in patients with ED compared to a normal control population.

More recent studies support the theory that the neuromodulation mechanisms remain altered in some subtypes of these disorders after their clinical recovery. This supports the theory that there may be a different basis for different types of disorders. So, for example, bulimia has much in common with other addictive disorders, and in fact, opiate antagonists have been successfully applied in its treatment. Furthermore, the administration of low-dose testosterone to anorexic women partially normalises the cerebral metabolic alterations seen in these patients. These observations open the door to an approach using individualised new pharmacological and psychotherapeutic treatments, for which it is necessary to extend the knowledge of the physiopathology of these processes and associated phenomena.

Losses in volume and cerebral atrophy, generally reversible, have been shown in some brain regions using CAT and NMR. These abnormalities have been related with metabolic causes such as protein-loss syndromes and fluid retention due to malnutrition, so it is unclear whether these alterations are at the origin of the disease or if they are the cause of it.

We found hypoperfusion in the inferior region of the left temporal lobe, confirming the visual impression with semi-quantitative analysis which showed statistically significant differences (p < 0.05) in patients in the acute phase of the disease in a first episode or close to it.

This is not the first time that these types of changes in the cerebral perfusion of this region have been related with anorexia disorders. Cases of patients with epileptic foci, angiomias or structural lesions of the temporal lobe in whom anorexia has been associated have been published.

Some authors, in their studies, have found similar alterations and have suggested that a dysfunction of the visuospatial capabilities may be related with a distorted perception of their own body. Our findings reinforce the idea that temporal lobe dysfunction is involved in the acute phase of these disorders and we believe that more long-term, prospective studies are needed to better understand the physiopathology of these diseases and for that knowledge to contribute to better control, treatment or future prevention of the disorders.

As a study limitation, we think that stricter or more regulated control of the different nutritional parameters would have helped to rule out the effect of malnutrition as a principal cause of the findings; however, the fact that these were one-sided seems to take away weight from this consideration.

CONCLUSION

Patients with ED frequently show hypoperfusion of the anteroinferior region of the temporal lobe, predominantly on the left, in the acute phase of the illness. Our study marks a starting point indicating the need for studies which deepen our knowledge of the physiopathology and neurobiological basis of these diseases.

BIBLIOGRAPHY


Table 3
LEFT/RIGHT INDICES OF THE TEMPORAL REGION IN SLICE N1 IN THE NORMAL CONTROL GROUP

<table>
<thead>
<tr>
<th>Controls</th>
<th>Left/right index</th>
</tr>
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<tbody>
<tr>
<td>Control 1</td>
<td>0.98</td>
</tr>
<tr>
<td>Control 2</td>
<td>1.02</td>
</tr>
<tr>
<td>Control 3</td>
<td>0.92</td>
</tr>
<tr>
<td>Control 4</td>
<td>0.98</td>
</tr>
<tr>
<td>Control 5</td>
<td>0.98</td>
</tr>
<tr>
<td>Control 6</td>
<td>0.95</td>
</tr>
<tr>
<td>Control 7</td>
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</tr>
<tr>
<td>Control 8</td>
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</tr>
<tr>
<td>Control 9</td>
<td>0.99</td>
</tr>
<tr>
<td>Control 10</td>
<td>0.96</td>
</tr>
<tr>
<td>Control 11</td>
<td>0.97</td>
</tr>
<tr>
<td>Control 12</td>
<td>0.97</td>
</tr>
<tr>
<td>¯ x</td>
<td>0.97</td>
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<tr>
<td>SD</td>
<td>0.026</td>
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</tbody>
</table>

SD: standard deviation; ¯ x: mean.
Jiménez-Bonilla JF et al. Assessment of cerebral blood flow in patients with eating disorders in the acute clinical phase using Tc99m-HMPAO SPECT