SHORT REPORT

Corpora amylacea in hippocampal sclerosis

Wim Van Paesschen, Tamas Revesz, John S Duncan

Abstract
Corpora amylacea have been reported in around 60% of hippocampal sclerosis specimens. The aim was to determine whether there are clinical and quantitative hippocampal MRI differences between hippocampal sclerosis with and without corpora amylacea. Corpora amylacea density was determined in 46 resected hippocampi of patients with temporal lobe epilepsy, using a three dimensional microscopic counting technique. Forty one hippocampi had hippocampal sclerosis. Twenty six of the 41 (63%) hippocampal sclerosis specimens contained corpora amylacea, which were found in highest numbers in the CA1 subregion of the hippocampus. Corpora amylacea density in the CA1 correlated inversely with the neuronal density in CA1. Hippocampal sclerosis with corpora amylacea had the same clinical and quantitative hippocampal MRI characteristics as hippocampal sclerosis without corpora amylacea, and did not affect seizure outcome after surgery adversely. In conclusion, formation of corpora amylacea seems to be a pathological response to neuronal cell loss in most hippocampal sclerosis specimens, with no clear clinical and quantitative hippocampal MRI correlates.

(J Neurol Neurosurg Psychiatry 1997;63:513–515)

Keywords: corpora amylacea; hippocampal sclerosis; epilepsy; neuronal density

Corpora amylacea are globular basophilic bodies, 10-50 µm in diameter, which may stain deeply with iodine. They are commonly seen in the subpial tissue of the brains of elderly subjects. Corpora amylacea develop in astrocytic processes and are associated with neurodegeneration.1

Corpora amylacea can be found in temporal lobe epilepsy in the hippocampus2 and extra-hippocampal tissue with a predilection for the temporal white matter.3 MacKenzie4 reported corpora amylacea in 15 of 40 cases of temporal lobe epilepsy, half of them with hippocampal sclerosis. Chung et al5 reported hippocampal corpora amylacea in 22 of 38 (58%) hippocampal sclerosis specimens. Loiseau et al6 postulated that many corpora amylacea in a patient with hippocampal sclerosis might represent a localised form of a glycogen storage disease. Clinical correlates and MRI features of hippocampal sclerosis with and without corpora amylacea have not been reported.

We have used a three dimensional cell counting technique to quantify corpora amylacea and neuronal cell densities in hippocampal neuronal and granular cell layers of patients who underwent temporal lobe resection for intractable temporal lobe epilepsy.7 The aim was to study the presence of corpora amylacea systematically and quantitatively in a consecutive series of resected hippocampi of patients with temporal lobe epilepsy and to determine whether there are clinical and quantitative hippocampal MRI differences between hippocampal sclerosis with and without corpora amylacea.

Methods

STUDY POPULATION

Forty six patients (18 men, 28 women; median age 31, range 14-52 years) who had died from non-neurological causes were obtained at necropsy. None of the control hippocampi showed hypoxic or other neuropathological changes.

CLINICAL EVALUATION

Age at onset of habitual epilepsy, duration of epilepsy, a history of febrile convulsions and meningoencephalitis, age at the time of these events, family history of febrile convulsions and epilepsy, seizure types and description, average frequency of each seizure type during the year preceding the operation, and total number of secondary generalised seizures in their lifetime were established. In those who had a postoperative follow up of at least one year, outcome was rated as 1, no seizures or auras only, 2 >90% reduction in seizures, 3 >50% reduction
Numerous corpora amylacea in the CA1 hippocampal subregion of a patient with extrahippocampal tissues. The density of corpora amylacea in the CA1 (arrows) was more than three years after surgery. Pathologic examination of the resected temporal lobe performed by the same observer. Presurgically, MRI based hippocampal T2 (HCT2) and volumes (HCV) were determined for the pyramidal cell layer of the dentate gyrus (GCDG). Each hippocampal subregion was counted using 50 counting boxes with a random and systematic sampling strategy. Using similar methodology, neuronal cell densities were determined in the same hippocampal subregions, as reported previously. Statistic analysis was performed using SPSS for Windows, release 6 (SPSS Inc, Chicago, IL).

Table 1 Corpora amylacea densities in hippocampal subregions

<table>
<thead>
<tr>
<th>Hippocampal subregion</th>
<th>Controls (n=2; 33%)</th>
<th>Hippocampal sclerosis (n=26; 63%)</th>
<th>Endofulm sclerosis (n=2; 40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA1</td>
<td>288 (176–400)</td>
<td>17 544 (800–1 340 000)</td>
<td>0</td>
</tr>
<tr>
<td>CA2</td>
<td>0</td>
<td>0 (n=17)</td>
<td>0</td>
</tr>
<tr>
<td>CA3</td>
<td>0</td>
<td>800 (0–43 636)(n=16)</td>
<td>705 (0–1410)</td>
</tr>
<tr>
<td>Hilus</td>
<td>176 (0–352)</td>
<td>0 (0–181 319)</td>
<td>287 (0–574)</td>
</tr>
<tr>
<td>GCDG</td>
<td>0</td>
<td>0 (0–35 000)(n=25)</td>
<td>0</td>
</tr>
</tbody>
</table>

The median (range) corpora amylacea density for hippocampal subregions CA1, CA2, CA3, hilus, and granular cell layer of the dentate gyrus (GCDG) are shown for hippocampal specimens that had corpora amylacea in at least one hippocampal subregion. Corpora amylacea density is expressed in corpora amylaceae/mm³; n: number of hippocampal sclerosis specimens for which a particular hippocampal subregion was available for counting studies. In the other specimens, these regions were damaged during surgical removal. In one hippocampal sclerosis specimen, the GCDG was almost completely destroyed and technically difficult to count.

Table 2 Neuronal densities in hippocampal subregions

<table>
<thead>
<tr>
<th>Hippocampal subregion</th>
<th>Controls (n=6)</th>
<th>Hippocampal sclerosis with corpora amylacea (n=26)</th>
<th>Hippocampal sclerosis without corpora amylacea (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA1</td>
<td>20.3 (15.6–23.4)</td>
<td>2.6 (1.2–8.9)</td>
<td>2.8 (1.7–9.6)</td>
</tr>
<tr>
<td>CA2</td>
<td>30.2 (25.7–38.0)</td>
<td>20.0 (12.3–28.1)(n=17)</td>
<td>20.2 (14.8–32.4)(n=7)</td>
</tr>
<tr>
<td>CA3</td>
<td>16.4 (15.6–25.9)</td>
<td>4.9 (1.1–16.5)(n=16)</td>
<td>7.9 (3.8–8.4)(n=7)</td>
</tr>
<tr>
<td>Hilus</td>
<td>12.0 (8.6–14.9)</td>
<td>2.7 (0.9–8.6)</td>
<td>1.5 (0.6–9.6)</td>
</tr>
<tr>
<td>GCDG</td>
<td>482 (295–635)</td>
<td>180 (80–400)(n=25)</td>
<td>152 (41–270)(n=14)</td>
</tr>
</tbody>
</table>

Neuronal densities of five hippocampal subregions for control, hippocampal sclerosis with corpora amylacea and hippocampal sclerosis without corpora amylacea specimens; n: number of specimens for which a particular hippocampal subregion was available for counting studies. In the other specimens, these regions were damaged during surgical removal and therefore not available for quantitative neuropathological studies. In two hippocampal sclerosis specimens, the GCDG was almost completely destroyed and technically difficult to count. Neuronal densities are number of cells ×10⁶/mm³. Neuronal density is expressed as median (range). The neuronal densities of hippocampal sclerosis specimens with and without corpora amylacea are comparable.
Corpora amylaceae in hippocampal sclerosis

Results
Two control hippocampal specimens (33%), two end folium sclerosis specimens (40%), and 26 hippocampal sclerosis (63%) specimens contained corpora amylacea. Table 1 shows the corpora amylacea densities for the specimens that had corpora amylacea in at least one hippocampal subregion. The hippocampal subregion with the highest density of corpora amylacea was CA1 (figure). Table 2 shows the neuronal cell densities of control, hippocampal sclerosis with corpora amylacea, and hippocampal sclerosis without corpora amylacea. Neuronal cell densities of hippocampal sclerosis specimens with corpora amylacea were comparable with those of hippocampal sclerosis specimens without corpora amylacea. Using all available data from control, end folium sclerosis, and hippocampal sclerosis specimens, the corpora amylacea density of CA1 correlated with that of CA3 ($r=0.61; P<0.001$) and the hilus ($r=0.63; P<0.001$), and inversely with the neuronal density of CA1 ($r=-0.42; P=0.02$).

Clinical characteristics of the 15 patients with hippocampal sclerosis and no corpora amylacea and the 26 patients with hippocampal sclerosis and corpora amylacea in at least one hippocampal subregion were compared. There were no significant differences in median age of onset of habitual epilepsy (2 v 7 years), duration of epilepsy (24 v 21 years), a history of febrile convulsions (60% v 58%) and meningoencephalitis (7% v 7%), family history of febrile convulsions and epilepsy (13% v 20%), median number of complex partial seizures a month during the year preceding the operation (2 v 2.5), estimated median number of secondary generalised seizures in their lifetime (6 v 13), and seizure outcome after anterior temporal lobe resection. Median HCT2 (125 ms v 125 ms) and median MR based HCV (3698 mm$^3$ v 3686 mm$^3$) did not differ between these two groups.

Discussion
Corpora amylaceae are often found in hippocampal sclerosis. Chung et al. reported the presence of corpora amylacea in 58% of hippocampal sclerosis specimens, which is similar to the 63% in the present study. We found no evidence that hippocampal sclerosis with corpora amylacea had clinical and MRI characteristics that differed from hippocampal sclerosis without corpora amylacea. Chung et al. reported that the distribution of corpora amylacea paralleled the characteristic neuronal loss in hippocampal sclerosis, which we confirm quantitatively in the present work. When present, corpora amylacea are therefore seen in the highest numbers in the CA1 hippocampal subregion, which is the most severely affected region in hippocampal sclerosis. The inverse correlation of corpora amylacea density with neuronal cell densities supports the hypothesis that corpora amylacea may be the result of neuronal cell loss. The lack of clinical differences between hippocampal sclerosis with and without corpora amylacea indicate that corpora amylacea are an epiphenomenon of the pathogenetic process of hippocampal sclerosis.

We thank Action Research for financial support and Mister William Hatchings for performing the surgical resections.

References
3 Jackson GD, Berkovic SF, Tres BM, Kalimis RM, Fabinyi GC, Bladin PF. Hippocampal sclerosis can be reliably detected by magnetic resonance imaging. Neurology 1990; 40:1869–75.