Incidentally Identified Multiple Low-intensity Areas on T2-Weighted Images by MR Imaging

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Summary: Multiple small lesions of low intensity on T2-weighted images identified by MR imaging were observed in four patients. There were no definite associations between the patients' clinical symptoms and the lesions. MR imaging showed multiple, small areas with slightly high and/or low-intensities on T1-weighted images, and low intensities on T2-weighted images. In two patients these low intensity areas were increased in size with field echo images. These MR studies indicate that multiple ruptures and/or hemorrhagic infarctions of microaneurysms may occur in the brain without any clinical manifestations.

Key words: cerebral infarction—microaneurysm—magnetic resonance imaging—computed tomography—cerebral hemorrhage

Introduction

Recently, neuroradiological imaging techniques were advanced markedly with the advent of magnetic resonance (MR) imaging. In the pathogenesis of intracerebral hematoma, Gomori et al. (1985) described the imaging results from twenty intracerebral hematomas which had been presented from one day to more than one year, using MR at 1.5T with T1-and T2-weighted spin-echo pulse sequences. During the evolution of the hematomas, typical imaging characteristics were observed. During the acute stage of the hematoma (<1 week), central hypo-intensity on T2-weighted images was observed, while peripheral hyper-intensity was noted on T1-weighted and T2-weighted images in the subacute stage. At a chronic stage, hyper-intensity occurred in the area of the hematoma and hypo-intensity in adjacent areas of the brain on T2-weighted images. This hypo-intensity area was identified as the hemosiderin band.

Asymptomatic multiple cerebral infarctions detected by MR imaging increase with age. The therapeutic management remains controversial. This report describes four cases with multiple, small intracerebral lesions of low intensity on T2-weighted images that were unassociated with clinical symptoms. The MR findings for these four patients and the pathogenesis of multiple, small low intensity lesions are presented.
Patients and Methods

MR images were obtained using a 0.5T superconducting MR imaging unit (Shimadzu and Toshiba) with T1-weighted images (SE 600-800/15-30, IR 2000/600/35) and field echo (300-440/22-27/20-30).

Four patients (one male and three females) ranging from 55 to 78 years of age were included in the study (Table 1). A CT was performed on each patient, and two patients (cases 3 and 4) also had cerebral angiographies. Two patients (cases 1 and 2) complained of headache and dizziness, but the results of the neurological examinations were normal.

In the other two patients (cases 3 and 4), the neurological examinations revealed hemiparesis, but these findings were due to post-ictal states from a thalamic hemorrhage (case 3) and cerebral infarction (case 4). In two of the four patients, there were histories of systemic arterial hypertension, and one patient (case 4) had diabetes mellitus.

Results

The neuroradiological findings from all the patients are summarized in Table 2a. In every case, the MR imaging showed multiple small areas of slightly high and/or low intensities with T1-weighted images. The same areas were identified as low intensity on T2-weighted images. In two patients (cases 3 and 4), these low intensity areas were increased in size with field echo imaging (Figs 1a, b). These MR images were similar to those observed by Gomori et al. (1985) in old cerebral hematomas with hemosiderin.

Two of the four patients underwent cerebral angiography and the findings were normal. In all patients, the CT without contrast enhancement had areas of high and/or low densities. After intravenous infusion of contrast medium in case 2, a small enhancement was noted in the slightly high density areas (Fig. 2). MR imaging was distinctively superior to CT for identifying the multiple,

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Clinical symptoms</th>
<th>Neurological Findings</th>
<th>History</th>
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<tbody>
<tr>
<td>1</td>
<td>78</td>
<td>F</td>
<td>Headache</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
<td>F</td>
<td>Headache</td>
<td>NP</td>
<td>NP</td>
</tr>
</tbody>
</table>
| 3    | 58  | M   | Lt hemiparesis    | Lt hemiparesis       | Hypertension  
|      |     |     | 2 years before    |                      | Intracerebral hemorrhage |
| 4    | 55  | F   | Rt hemiparesis    | Rt hemiparesis       | Hypertension  
|      |     |     | 3 years before    |                      | Diabetes Mellitus cerebral infarction |

It: left    rt: right    NP: no positive findings
Fig. 1a. Case 3: Upper: the plain (left) and enhanced CT scans (right) demonstrated the periventricular low density areas. Lower: T1-weighted images (left), T2-weighted images (center) and field echo imaging (left). Increased sizes and numbers of small low intensity areas on field echo images were noted.

Fig. 1b. Case 4: Upper: the plain CT scan disclosed low density areas in the deep white matter (left). Small low intensity areas were observed on T1-weighted images (right). Lower: Field echo imaging (left) was superior to T2-weighted images (right) for identifying small low intensity areas.
small lesions.

Table 2b shows the distribution of low intensity areas on T2-weighted images. These small low intensity lesions were prominent in the regions of the basal ganglia, white matter and thalamus, and were also detected in the brain stem, cerebral cortex and cerebellum.

Fig. 2. Case 2: Upper: Plain (left) and enhanced (right) CT scans were obtained. Slightly enhanced small areas were noted. Lower: T1-weighted images (left) and T2-weighted images (right) were obtained and low intensity areas with central high intensity areas were observed.
Discussion

Using MR imaging, multiple small areas with abnormal intensities were identified in four patients. CT did not reveal any more areas with abnormal density than MR imaging. These small multiple abnormal lesions were unassociated with the symptomatology of the patients.

Gomori et al. (1985) described the characteristic intensity patterns during the evolution of intracerebral hematomas. In the chronic stages, MR showed hypo-intensity with T2-weighted images. As described above, the authors observed multiple small low intensity areas on T2-weighted images, with iso intensity or mild low intensity (like that of gray matter) on T1-weighted images.

These low-intensity areas on T2-WIs were increased in size with field echo. From the above MR imaging criteria, these multiple small low intensity areas on T2-weighted images are likely to represent the chronic stage of an intracerebral hematoma.

McCormik and Rosenfield (1973) reported that multiple hemorrhages were most frequently encountered in patients with blood dyscrasias (leukemia, hemophilia), neoplasms (primary or metastatic), vasculitis, sepsis, venous sinus thrombosis, angiomas, aneurysms or amyloid angiopathy. However none of the four patients had a clear identifiable cause for their multiple small hematomas,
even though two of the four patients had systemic arterial hypertension.

Recent investigations have clarified the pathogenesis of atherosclerosis. Involvement of endothelial injury is the initial contributing factor of atherogenesis. This may lead to intimal thickening (smooth muscle proliferation), and formation of microatheromas in the small vessels of the brain. At the same time, alterations and necrosis of smooth muscle of the media cause angionecrosis and microaneurysms.

Ross Russell (1963, 1986) observed microaneurysms in the region of the putamen, globus pallidus, thalamus, caudate nucleus, internal capsule, central semi-ovale, and cortical gray matter. In evaluating 54 autopsy cases small hemorrhages were identified, which had macrophages with iron deposits around the microaneurysms. From these pathological features and the evidence obtained from the MR results, the post-ictal states of rupture and/or hemorrhagic infarction of intracranial microaneurysms may have been present, but were not associated with the clinical findings in the present four cases.

References