Silent Stroke
Not Listened to Rather Than Silent

Monica Saini, MD; Kamran Ikram, MD, PhD; Saima Hilal, MBBS; Anqi Qiu, PhD; Narayanaswamy Venketasubramanian, FRCP; Christopher Chen, FRCP

Background and Purpose—The prevalence of silent brain infarcts varies from 8% to 28% in the general elderly population. Silent brain infarcts are associated with increased risk of subsequent stroke and cognitive dysfunction. By definition, silent strokes lack clinically overt stroke-like symptoms and fail to come to clinical attention; however, impaired recall of symptoms may be a potential confounder. Our aim is to report a series of patients with incidentally detected acute and subacute strokes and examine whether they were truly asymptomatic.

Methods—Subjects included in this study were drawn from ongoing dementia research studies at the Memory Ageing and Cognition Center, in which all participants underwent a cranial MRI. Incidental hyperintense lesions on diffusion-weighted imaging with corresponding apparent diffusion coefficient defects indicative of acute/subacute silent stroke were identified. Clinical data for individuals with incidental hyperintense lesions on diffusion-weighted imaging were collated.

Results—Six of 649 subjects had incidental hyperintense lesions on diffusion-weighted imaging; on retrospective questioning, 3 recalled symptoms temporally correlated with MRI lesions, which had been reported to but ignored by family members. Two subjects had focal neurological signs. A majority of the subjects with incidental hyperintense lesions on diffusion-weighted imaging had significant cognitive impairment.

Conclusions—A significant number of strokes may be “silent” due to lack of awareness of stroke-like symptoms in the elderly and their families. Enhanced stroke prevention education strategies are needed for the elderly population and, in particular, for their families. (Stroke. 2012;43:3102-3104.)

Key Words: acute stroke ■ asymptomatic diseases ■ diffusion-weighted imaging

Infarcts are classified as “silent” when they are detected on brain imaging but lack temporally correlated stroke-like symptoms. Prevalence of silent brain infarcts (8%–28%) increases with age and is higher in those with a history of stroke or dementia.1-3 Presence of silent brain infarcts increases risk of subsequent stroke and significantly increases the risk of cognitive impairment.4,5 Cardiovascular risk factors known to increase the risk of stroke are also associated with silent brain infarcts;1 thus, timely institution of preventive treatment strategies in individuals with “silent strokes” may be critical for reducing risk of subsequent stroke and dementia. Classification of strokes as “silent” is based on recall of neurological stroke-like symptoms or transient ischemic episodes by the patient. However, symptoms may be forgotten or ignored, especially in patients with cognitive impairment or social isolation, thus delaying or escaping medical attention. We report incidentally detected acute and subacute strokes and examine whether they were truly asymptomatic.

Methods
We collated imaging and clinical data from subjects recruited in MRI studies at the Memory Ageing and Cognition Center of the National University Health System, Singapore. Informed consent was obtained from each subject. Data on demographics and medical history (including history of cerebrovascular events) was obtained, clinical assessment performed, and a validated neuropsychological battery (Vascular Dementia Battery)6 administered for determining cognitive status.

Neuroimaging
MRIs were performed at the Clinical Imaging Research Centre on a 3-T Siemens Magnetom Trio Tim scanner. Imaging protocol included T1- and T2-weighted, diffusion-weighted imaging, apparent diffusion coefficient, fluid-attenuated inversion recovery, susceptibility-weighted imaging, and MR angiography. Hyperintense lesions on diffusion-weighted imaging with corresponding hypointense areas on apparent diffusion coefficient were defined as acute/subacute ischemic stroke. Lesions were labeled “incidental” (IHDWI) if subjects, or their families, did not voluntarily report symptoms or seek medical attention.
Results

Over a period from August 2010 to May 2012, 649 subjects underwent an MRI. One hundred forty-six subjects (22.4%) had evidence of nonacute infarcts; 77 (11.8%) did not give any clinical history of stroke or transient ischemic attack. IHDWIs were seen in 6; demographic and clinical characteristics of these individuals are tabulated (Table 1). Mean age of subjects with IHDWI was 79.3 ± 4.6 years. All subjects with IHDWI had ≥ 1 vascular risk factors; none had a history of clinically evident stroke.

Characteristics of IHDWI and associated MRI features are presented (Table 2; Figure). Five IHDWIs were subcortical; one was at the gray–white junction. Five subjects with IHDWI had significant white matter disease (Fazekas scale),7 and 4 had multiple microbleeds. Neuropsychological assessment revealed significant cognitive impairment in 5; 4 were diagnosed as CIND–moderate (cognitively impaired, not demented) and one fulfilled Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition criteria for dementia.

Subjects with IHDWI were interrogated specifically for stroke-like and other symptoms on the day or in days preceding MRI. In 3 subjects, acute-onset symptoms (interval from MRI 0–4 days) had been reported to or noted by the families. However, symptoms were dismissed as not requiring medical attention. In 2, the symptoms were regarded as part of ongoing cognitive impairment; in another, ataxia was attributed to “confusion.” Three subjects did not recall any symptoms. One subject (ID 1) with no history of stroke-like symptoms had focal neurological signs, which may have been secondary to an earlier “silent stroke” (old cerebellar infarct).

All subjects were referred to emergency care services for hospital admission; however, one subject declined further medical evaluation. Appropriate treatment modifications (addition of antipatelet medication, statins) were made for the other 5 subjects during their hospital stay.

Discussion

Silent brain infarcts differ from symptomatic strokes in that they lack stroke-like symptoms and fail to reach medical attention; their prognostic implications are significant in terms of serving as biomarkers for risk of subsequent stroke and dementia.4,5 Although the prevalence of silent brain infarcts has been reported in various studies, data on presence of “silent” acute/subacute diffusion-weighted imaging lesions are scarce. Yamada et al8 reported incidental acute infarcts in 0.37% of their study population undergoing MRI in a

Table 1. Characteristics of Subjects With IHDWI

<table>
<thead>
<tr>
<th>ID</th>
<th>Sex</th>
<th>Age, y</th>
<th>Vascular Risk Factors</th>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>78</td>
<td>HT, DM, IHD, CRF</td>
<td>None</td>
<td>Left upper limb ataxia</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>85</td>
<td>HT</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>78</td>
<td>Dyslipidemia</td>
<td>Left lower limb clumsiness 4 d previously</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>81</td>
<td>HT, DM, dyslipidemia, IHD</td>
<td>Lethargic for 2–3 d</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>73</td>
<td>HT, dyslipidemia</td>
<td>Imbalance at the time of walking for a few hours</td>
<td>Gait ataxia; confusion; left upper limb apraxia</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>81</td>
<td>HT, IHD</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

IHDWI indicates incidental hyperintense lesions on diffusion-weighted imaging; HT, hypertension; DM, diabetes mellitus; IHD, ischemic heart disease.

Table 2. MRI Features in Subjects With IHDWI

<table>
<thead>
<tr>
<th>ID</th>
<th>PV</th>
<th>DWM</th>
<th>Chronic Lacune</th>
<th>IHDWI Characteristic</th>
<th>Microbleeds</th>
<th>Intracranial Stenosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>Cerebellar</td>
<td>Left parietal deep subcortical</td>
<td>Basal ganglia, thalamus, subcortical, brain stem, cerebellar</td>
<td>Left vertebral, right ICA</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>...</td>
<td>Right parietal subcortical</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>Subcortical</td>
<td>Right parietal, subcortical</td>
<td>...</td>
<td>Right MCA; basilar, left vertebral</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>3</td>
<td>Pons, thalamus, basal ganglia</td>
<td>Right splenium and caudate (2 lesions)</td>
<td>Thalamus and subcortical</td>
<td>Right MCA, right vertebral</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>2</td>
<td>...</td>
<td>Right parietal, gray–white junction</td>
<td>Basal ganglia, thalamus, deep white matter, cerebellar</td>
<td>...</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>2</td>
<td>...</td>
<td>Right parietal, gray–white junction</td>
<td>Cerebellum, pons, bilateral gray–white junction</td>
<td>Right vertebral</td>
</tr>
</tbody>
</table>

IHDWI indicates incidental hyperintense lesions on diffusion-weighted imaging; PV, periventricular; DWM, deep white matter; ICA, internal carotid artery; MCA, middle cerebral artery; intracranial stenosis, ≥50% reduction in vessel lumen; chronic lacune, hypointense fluid-attenuated inversion recovery lesion >2 mm, with hyperintense ring.
hospital-based setting, for a large variety of indications, including a recent stroke; however, data regarding temporally correlated symptoms were not collected. Incidental acute diffusion-weighted imaging lesions have also been previously reported in patients of cerebral autosomal-dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL); 49% of these patients had acute hemorrhages and 15% had chronic memory loss or nonspecific symptoms.9

The “silence” of stroke has been attributed to occurrence in clinically ineloquent areas. However, we observed that the “silence” was also attributable to symptoms and signs being ignored. Although subjects reported symptoms, neurological and otherwise, to caregivers, they were not deemed to be significant. The majority of subjects with IHDWI had significant cognitive impairment, and it is possible that this may have played a role in underrecognition of symptoms, inability to specify character of deficit (lethargy), or reduced credibility.

Five subjects with IHDWI had significant white matter disease and 2 had evidence of old lacune(s). It has been shown previously that almost 30% of lacunar infarcts do not cavitate.89 Thus, if imaged in the chronic phase, almost one third of patients with lacunar strokes may, in fact, escape medical attention. Control of vascular risk factors and prevention of stroke are critical for minimizing the development and progression of cognitive impairment and dementia. The profiles of our subjects with incidental acute strokes underline the urgent need for sensitizing families and caregivers of the elderly regarding recognition of stroke-like symptoms.

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Disclosures
None.

References
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