Embolic Lesion Pattern in Stroke Patients With Patent Foramen Ovale Compared With Patients Lacking an Embolic Source

Marek Jauss, MD; Tiemo Wessels, MD; Susan Trittmacher, MD; Jens Allendörfer, MD; Manfred Kaps, MD

Background and Purpose—Multiple acute ischemic lesions on diffusion-weighted magnetic resonance imaging (DWI-MRI) are thought to be of embolic origin. However, in several patients with multiple ischemic lesions on DWI-MRI, no embolic source was detected, despite a thorough clinical work-up. Stroke etiology in such cases is then classified as cryptogenic. In other patients, a potential embolic source is limited to a patent foramen ovale (PFO) that may act as an embolic source of unsure relevance. We therefore examined the prevalence of the multiple-lesion pattern in patients with cryptogenic stroke compared with patients with PFO.

Methods—We screened 650 stroke patients by DWI-MRI. For the subsequent evaluation, we excluded patients with a cardiac embolic source other than PFO, symptomatic carotid artery disease, and other apparent stroke causes, such as dissection or vasculitis, and patients whose diagnostic work-up was incomplete. For the remaining 106 patients, we found DWI lesions in 73, who were subjected to further evaluation.

Results—There were no differences in the occurrence of the multiple-lesion pattern in patients with cryptogenic stroke compared with patients with PFO, either for the entire group or for the subgroup of young stroke patients who were <50 years old. Patients with PFO showed a significantly higher incidence of multiple lesions in the posterior circulation.

Conclusions—The multiple-lesion pattern on DWI-MRI is not uncommon, even when extensive testing does not reveal any embolic source. Therefore, it is not possible to discriminate between cryptogenic stroke and stroke from an assumed paradoxical embolism. (Stroke. 2006;37:2159-2161.)

Key Words: foramen ovale, patent ▶ magnetic resonance imaging, diffusion-weighted
Two representative DWI-MRI slices for a patient with PFO and multiple lesions in the posterior territory.

(n=118), other apparent stroke causes such as dissection or vasculitis (n=20), or an apparent embolic source (atrial fibrillation, n=105; aortal plaques, n=44; dilated ventricle, n=40; other cardiac embolic sources, n=41). One hundred seventy-seven patients were excluded because the work-up data were incomplete. For the remaining 106 patients, we found DWI lesions in 73 patients who were subjected to further evaluation. In the group with negative MRI findings, the PFO incidence was 36% (n=12) compared with 49% PFO-positive patients in the patient group with DWI lesions on MRI.

Patients underwent DWI-MRI usually within 72 hours of symptom onset by a 1.5-T whole-body scanner (General Electric) with echoplaner imaging data capability. The study protocol has been published previously.6 Because the aim of DWI-MRI was to disclose stroke etiology rather than to search for early infarct signs, the time between onset of symptoms and MRI scan was at least 8 hours. All MRI-scans were assessed by both a neuroradiologist and a neurologist who were blinded to the clinical findings.

Ischemic DWI lesions were classified as (1) single lesions, (2) multiple lesions (see the Figure) in 1 vascular territory (anterior or posterior circulation), and (3) multiple lesions in >1 vascular territory, as suggested in previous studies wherein multiple lesions were considered to be of embolic origin.1,4,7 The presence of cardiac right-to-left shunting was examined by TEE with an intravenous contrast agent (Echovist) and confirmed by a transcranial Doppler test for right-to-left shunt.8 Only patients with positive results on both tests were considered as having a right-to-left shunt on the cardiac level. Statistical analysis was performed with Fisher’s exact test.

Results

The mean age of the study patients was 53.1±16.1 (range, 18 to 88) years, and 28 patients (38%) were female. The time from onset of symptoms to MRI examination was 2.2±1.4 (range, 1 to 8) days.

There was no significant difference in the occurrence of the multiple ischemic lesion pattern in patients with cryptogenic stroke compared with patients with PFO, either for the entire group or for the subgroup of young stroke patients who were ≤50 years old. Patients with the multiple ischemic lesion pattern showed significantly more lesions in the posterior circulation (the Table), with a positive prediction value for PFO in cases of multiple emboli in the posterior circulation of 0.99 (0.51 to 1), a specificity of 0.99 (0.88 to 1), and a sensitivity that was low, 0.20 (0.07 to 0.35).

Discussion

We report on a selected group of patients from a cohort of stroke patients who often present with the problem of determined stroke etiology. The failure to disclose an embolic source of stroke in patients with an embolic stroke pattern by MRI is not uncommon, despite extensive testing. Therefore, the multiple ischemic lesion pattern is not limited to patients with stroke and PFO. Only in young patients (<50 years) was there a remarkably high positive predictive value of 75% for the presence of PFO in cases of the multiple ischemic lesion pattern on MRI. The observation that stroke due to paradoxical embolism affects mainly the posterior circulation is supported by a single-photon emission computed tomography study and is possibly a specific feature of paradoxical embolism.9

The limitations of this study are possible bias due to patient selection for DWI-MRI, because cooperation of the patient is required for this examination, and a possible bias in patient selection for TEE, because TEE, though part of our stroke work-up program, was performed as an invasive procedure only in patients who would have been expected to derive a possible therapeutic consequence.

In conclusion, the multiple ischemic lesion pattern is common in PFO patients, but it can also be demonstrated in a subgroup of patients in whom no obvious source of embolic stroke can be demonstrated. The multiple ischemic lesion pattern in the posterior circulation is associated with the presence of PFO.
Disclosures

None.

References

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Stroke. 2006;37:2159-2161; originally published online July 6, 2006;
doi: 10.1161/01.STR.0000231645.22128.ab
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/37/8/2159

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