Intracranial Steno-Occlusive Arterial Disease and its Associations in Egyptian Ischemic Stroke Patients

Ramez Reda Moustafa, MD, PhD, MRCP; Amr Abdel Moneim, MD; Haitham Hamdy Salem, MD; Ali Soliman Shalash, MD; Hosam Ahmed Azmy, MD

Background and Purpose—Intracranial arterial steno-occlusive disease is prevalent among non-white populations. We explored whether a similar pattern exists in Egyptians and assessed its clinical-radiological associations.

Methods—Consecutive acute ischemic stroke patients were recruited for 6 months and had magnetic resonance imaging/magnetic resonance angiography of brain within 2 days of the event. Magnetic resonance angiography was analyzed for significant stenosis (>50%), flow gaps, and complete occlusions in the major intracranial arteries.

Results—A total of 143 patients completed the study (62.4±12.6 years, 58.7% males). Magnetic resonance angiography showed symptomatic arterial stenosis in 27.3%, asymptomatic stenosis in 16.1%, and occlusions in 23.7% patients. Carotid duplex showed stenosis >70% in only 7.7% patients. Patients with intracranial arterial steno-occlusive disease had higher National Institutes of Health Stroke Score at admission (10.9±7 versus 8±5.6; P=0.01).

Conclusion—Symptomatic and asymptomatic intracranial arterial steno-occlusive disease was prevalent in this Egyptian acute stroke sample. This might have important implications on stroke management in this population. (Stroke. 2013;44:538-541.)

Key Words: Egyptian ■ intracranial stenosis ■ ischemic stroke ■ MRA ■ MRI ■ steno-occlusive disease

Intracranial atherosclerotic steno-occlusive disease (ICSD) is an important cause of stroke and stroke recurrence.1 It is relatively uncommon in white patients but is present in up to 28% to 65% of Chinese, Japanese, Hispanic, and black stroke patients.2

Little is known about ICSD in North Africa and the Middle East. In this study, we used magnetic resonance angiography (MRA) to investigate the prevalence of ICSD and assess its clinical-radiological associations in a hospital-based sample of acute ischemic stroke patients in Cairo, Egypt.

Methods

Patients

Between June and December 2011, we identified consecutive acute ischemic stroke patients (age >18 years) admitted to Ain Shams University Specialized Hospital Stroke Unit, Cairo, Egypt. Patients were excluded if they had contraindications to magnetic resonance imaging (MRI) or could not tolerate it. Only Egyptian patients were included (>97% belong to 1 ethnic group/race). Echocardiography, ECG, and carotid duplex ultrasonography were also performed. National Institutes of Health Stroke Score was performed at admission and at 1 week.

All patients gave informed consent. The study was approved by the Ain Shams University Local Research ethics committee.

Magnetic Resonance Acquisition

Brain MRI was acquired within 2 days of stroke onset, using a 1.5 T machine (Signa Prospeed, GE, United States). This included standard T1W, T2W, Fluid Attenuation Inversion Recovery sequences in addition to axial single-shot multislice diffusion-weighted echo-planar imaging (b-value =1000, echo time/repetition time 112/6300 ms) and time-of-flight MRA (echo time/repetition time 6.9/36 ms).

Image Analysis

Two experienced readers (A.A.M. and H.H.S.) visually analyzed the MRI and MRA images (inter- and intraobserver agreement for stenosis/occlusion in any artery: κ=0.89 and 0.91, P<0.01, respectively; and for middle cerebral arteries stenosis: κ=0.88 and 0.9, P<0.01, respectively). A consensus decision was made for discordant readings.

Stenosis (segmental flow gap or laminar stenosis >50% or occlusion (nonvisualized vessel segment with absent distal flow) were assessed in proximal middle cerebral arteries, proximal anterior cerebral arteries, intracranial internal carotid artery, proximal posterior cerebral arteries, vertebral arteries, and the basilar artery.

Stenosis was quantified using the measurement tools of the native MRI viewer according to standard methods3 (Figure). Arterial lesions corresponding to the location/territory of the recent infarct on diffusion-weighted imaging were considered symptomatic.

Data Analysis

Analysis was done in SPSS version 16 (SPSS Inc, Chicago, IL) using 1-way ANOVA (continuous variables), Pearson correlation coefficient, and χ² test (dichotomous variables).

Results

General Characteristics

A total of 177 consecutive patients were identified and 143 completed the study (13 denied consent, 6 had absolute...
In intracranial stenosis in Egyptian stroke patients, contraindications to MRI, 10 were claustrophobic or could not tolerate the scan, and 5 died before MRI. Excluded patients whose clinical data were available did not differ in their demographic or risk factor profile from the study group (all \( P > 0.05 \); Table in the online-only Data Supplement). Characteristics of the recruited population are shown in Table 1. Carotid duplex was available in 89 patients (58%) and showed significant carotid stenosis (\( \geq 70\% \)) in only 11 patients (7.7%).

**Brain MRI**

**Diffusion-Weighted Imaging**

Regarding new infarcts on diffusion-weighted imaging, 121 patients (84.6%) had unilateral new infarcts, 16 patients (11.2%) had bilateral new infarcts, and 6 (4.2%) had no new infarcts. Only 4 of the 16 patients with bilateral infarcts had atrial fibrillation. Infarcts were in the left side in 60.1% of patients. The most common types of infarcts were anterior territorial (28.1%) and anterior deep (23.5%) infarcts. Small deep infarcts (lacunes) and watershed infarcts were the least common (17.6% and 2% of all infarcts, respectively).

**Intracranial MRA**

Arterial segments with stenosis (n=130) and occlusions (n=39) were found in 96 patients (67.1% of the patients; Table 2). Stenosis, occlusion or both affected \( \geq 2 \) arterial segments in the same patient in 53 of 96 patients, and there was a very significant correlation between advancing age and the number of intracranial sten-occlusive lesions (\( R = 0.2, P = 0.01 \)). Thirty-nine patients (27.3%) had symptomatic stenosis, whereas 23 (16.1%) had asymptomatic stenosis not corresponding to a recent infarct.

Thirty-five patients had arterial occlusions (single isolated symptomatic occlusion in 24; asymptomatic multiple occlusions in 3). The remaining 8 patients with occlusion had coexisting stenosis (7 symptomatic). Occlusions were most common in the intracranial internal carotid artery (n=15) and middle cerebral arteries (n=31) and intracranial internal carotid artery (n=21). The anterior cerebral arteries were the least affected by stenosis or occlusion. Intracranial occlusions were not associated with atrial fibrillation (7 of 26 versus 28 of 117 for patients with and without atrial fibrillation, respectively, \( P = 0.8 \)).

Patients with stenosis or occlusion had significantly higher National Institutes of Health Stroke Score at admission than those without ICSD (\( P = 0.01 \); Table 1). Follow-up National Institutes of Health Stroke Score was also higher in patients with occlusions and those without ICSD (\( P = 0.039 \)).

**Discussion**

This study documents a high prevalence of ICSD in Egyptian acute stroke patients. Using MRA, we have found that 67% of acute ischemic stroke patients imaged within 48 hours had...
Evidence of stenosis, occlusion, or both in at least 1 proximal intracranial arterial segment and that symptomatic intracranial stenosis is present in at least 27%. This has significant prognostic implications, especially, because ICSD has a poorer prognosis than most other subtypes of stroke even with intensive medical therapy.4,5 Our findings were compared with the results found in different non-white ethnic groups and geographical locations.2 In native Chinese stroke patients, intracranial stenosis is found up to 35% of cases6 and in Korea, 52% of patients had severe ICSD.7 Studies on American blacks and Hispanics also show that intracranial atherosclerotic disease is several fold higher than in whites.8,9 Of note, most of these studies have also shown that extracranial carotid stenosis is much less common than ICSD and much less prevalent than in white patients.2 We cannot draw definite conclusions from our data regarding extracranial carotid stenosis, yet a recent study suggests that significant stenosis is indeed quite rare in Egyptians.10

Compared with other angiographic modalities, MRA is noninvasive, requires no radiation or contrast exposure, and has good positive (65%) and negative (90%) predictive values for stenosis ≥50% or occlusion.11

Our study was limited by the number of patients and would benefit from a larger sample recruited over a longer period. Patients excluded from the study did not undergo an alternative angiographic technique. It is, however, unlikely...
ICSD prevalence in those patients is different from the study group, because they had similar vascular risk factor profile, demographics, and stroke characteristics. MRA was done early in acute stage, and thus potentially steno-occlusive lesions may have been exaggerated. Including repeat imaging in later studies would ascertain the proportion of occlusive lesions that are truly atherosclerotic and not embolic in nature.

Conclusion

This study suggests that intracranial arterial stenosis is prevalent in the Egyptian stroke population, similar to most non-white populations. If confirmed in other studies, this will have important implications for the care of stroke patients in Egypt and the Middle East region.

Disclosures

None.

References

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SUPPLEMENTAL MATERIAL
**Supplemental Table.** Clinical characteristics of patients identified but not recruited to the study because MRI contraindications, claustrophobia or death.

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<th>Patients identified but excluded from the study (n=21)</th>
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