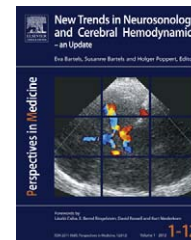




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Symptomatic intracranial stenosis: A university hospital-based ultrasound study

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KEYWORDS

Ischemic stroke;
Intracranial stenosis;
Atherosclerosis

Summary

Introduction: Stenosis of intracranial arteries are responsible for 30–50% of strokes in Orientals, 11% in Hispanics, 6% in Blacks and only 1% in Caucasians. However, the clinical importance of intracranial stenosis in Whites may have been underestimated.

Subjects and methods: We examined our database registry of all TIA/ischemic stroke Caucasian patients over a two-year period, from January 1st 2009 to December 31st 2010. All patients underwent a complete cervical and intracranial ultrasound assessment, MRA and/or CTA and/or DSA.

Results: Among 292 patients (males 79.7%; mean age, 71.0 ± 12.8 years), we found 59 (20.2%) subjects harboring at least one intracranial stenosis and 20 (33.9%) patients with 2 stenosis; the total number of intracranial stenosis was 95. Regarding risk factors, hypertension was present in 67.8% of patients, diabetes in 27.1%, smoking in 30.5%, obesity in 10.2%, hypercholesterolemia in 37.3%, previous TIA/stroke in 23.7%, heart disease in 18.6%. Forty-six (77.9%) patients presented with stroke, while 13 (22.1%) with TIA. Concerning the site of stenosis, 50 (52.6%) were located in the anterior circulation [MCA 46 (48.4%), ACA 4 (4.2%)], 45 (47.4%) in the posterior circulation: [PCA 28 (29.5%), BA 11(11.6%), VA 6(6.5%)]; 46 (54.8%) on the right hemisphere, 38 (45.2%) on the left hemisphere.

Conclusions: In this university hospital-based study among Caucasian patients with acute cerebral ischemia, ultrasound disclosed a higher prevalence of intracranial stenosis than previously thought, suggesting the clinical importance of this condition in White European TIA/stroke patients.

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Introduction

Intracranial atherosclerotic disease (ICAD) is characterized by the development and progression of atherosclerotic

lesions affecting large intracranial arteries. According to the international literature ICAD is a common cause of ischemic stroke worldwide [1,2], with a high recurrence stroke rate [3], representing the cause of 30–50% strokes in Orientals, 11% in Hispanics, 6% in Blacks but only 1% in Caucasians [4]. However, the clinical importance of intracranial stenosis in Caucasians may have been underestimated. A French autoptic series of 339 patients who died from ischemic or hemorrhagic stroke showed a strikingly high prevalence of intracranial stenosis (43.2%) [5]. For these reasons, we

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Table 1 Risk factors in patients with intracranial stenosis.

Risk factor	Number of patients	%
Hypertension	40	67.8%
Hypercholesterolemia	21	37.3%
Smoking	18	30.5%
Diabetes	16	27.1%
Previous stroke/TIA	13	23.7%
Heart disease	11	18.6%
Diffuse arterial disease	9	15.3%
Obesity	6	10.2%
Alcohol abuse	2	3.4%
≥1 risk factor	45	76.3%

conducted a University Hospital-based study to assess the prevalence of ICAD in our Caucasian patients with TIA or ischemic stroke.

Subjects and methods

A prospectively compiled, computerized database of all Caucasian patients with TIA/ischemic stroke who were admitted to our Clinic over a two-year period, from January 1st 2009 to December 31st 2010, was analyzed. All patients underwent a complete cervical and intracranial ultrasound assessment with a high-resolution color-coded duplex sonography scanner (Philips iU22) using a high frequency (5–10 MHz) linear probe for the cervical arteries and a low frequency (1–3 MHz) phased-array probe for the intracranial arteries. The examination was performed by an experienced neurosonographer in the same room, in a quiet atmosphere, with the subjects lying in a supine position. Only patients with the following characteristics entered the final analysis: (1) >50% intracranial stenosis [6] in any major intracranial artery at TCCD. (2) Diagnostic confirmation by Magnetic Resonance Angiography/CT Angiography/Digital Subtraction Angiography. (3) Persistent >50% intracranial stenosis at 6-month follow-up TCCD assessment, in order to exclude a “stenosis” of cardioembolic origin.

Results

Among 292 patients included into our study, 59 (20.2%) subjects harbored at least one intracranial stenosis, while 20 (33.9%) patients had 2 stenosis; the total number of intracranial stenosis was 95. The patients were mainly males (79.7%) and their mean age was 71.0 ± 12.8 years, with an age range between 33 and 96; mean age in women was 75.0, in men 69.7 years. The most frequent risk factor was hypertension, present in 40 (67.8%) patients. Hypercholesterolemia was present in 21 (37.3%), diabetes in 16 (27.1%), smoking in 18 (30.5%), obesity in 6 (10.2%), previous TIA/stroke in 13 (23.7%), and heart disease in 11 (18.6%) (Table 1). Forty-six (77.9%) patients presented with ischemic stroke, while 13 (22.1%) with TIA. Concerning the site of stenosis, 50 (52.6%) were located in the anterior circulation [MCA 46 (48.4%), ACA 4 (4.2%)], 45 (47.4%) in the posterior circulation [PCA 28 (29.5%), BA 11 (11.6%), VA 6 (6.5%)] (Table 2); 46 (54.8%) on the right hemisphere, 38 (45.2%) on the left one.

Table 2 Intracranial stenosis: frequency by site.

Site of stenosis	Number of patients (%)
MCA	46 (48.4%)
ACA	4 (4.2%)
PCA	28 (29.5%)
BA	11 (11.6%)
VA	6 (6.5%)

Discussion and conclusions

In this university hospital-based study among Caucasian patients with acute cerebral ischemia, ultrasound revealed intracranial stenosis in 20.2% of patients, a higher prevalence than expected on the basis of previous reports [2]. Furthermore, more than one third of these patients were found to harbor at least two intracranial stenoses, suggesting the clinical importance of this condition in white Italian patients with TIA or acute ischemic stroke.

In our opinion, ICAD might be relatively neglected in Caucasian patients, because the main focus is maintained on a more accessible disorder, such as extracranial carotid artery occlusive disease [7] and in many cases the diagnosis is not actively sought, because of the “a priori” assumption that the condition is relatively rare.

Moreover, compared to cervical artery stenosis, atherosclerotic lesions of intracranial vessels cannot be directly visualized by ultrasound and therefore it is not possible to collect information on the characteristics of the plaque. They are detected at a late stage, when they alter blood flow and are more susceptible to embolize.

In our population, ICAD was more frequent in males, who were also younger than females, confirming previous data on atherosclerotic disease [8]. The most relevant risk factor for ICAD in our study resulted to be hypertension, followed by hypercholesterolemia; previous reports have shown similar results and aggressive treatment of these risk factors has been shown to reduce the recurrence of ischemic stroke in patients with intracranial stenosis [9, 10].

Our data do not show a significant difference in the location of stenosis (anterior circulation compared to posterior circulation) suggesting that intracranial atherosclerotic disease is part of a widespread pathology, so that an accurate examination of the entire Circle of Willis is advisable in all patients with stroke or TIA, considering also the high risk of stroke recurrence in ICAD patients.

In conclusion, according to this study ICAD must enter into the differential diagnosis of Caucasians patients with acute cerebral ischemia, because it is a more frequent cause of stroke than previously reported.

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