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Carotid Doppler Ultrasonography In Young Stroke Patients

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Abstract

Background: The present study focuses on the role of carotid doppler ultrasonography (CDUS) in the diagnosis and management of carotid stenosis in young stroke patients.

Methods: The findings of carotid doppler in 45 ischemic stroke patients between 15-45 years of age were reviewed retrospectively. The variables of interest for this study included risk factors for atherosclerotic disease, primary abnormality detected on carotid doppler ultrasonography (ulceration vs. stenosis), degree of stenosis and the type of plaque (soft vs. calcified).

Results: The prevalence of hypertension and diabetes was 50% and 35% respectively. The rate of carotid stenosis in the study population was found to be 31%. The degree of stenosis was mild in 35% and moderate in 21%. High-grade stenosis was found in 21% of patients. The plaque was soft in the majority of cases (43%).

Conclusion: The proportion of carotid stenosis in young stroke patients was relatively high compared with previous studies. This may be due to an increase in the risk factors for atherosclerotic disease in developing countries (JPMA49:97, 1999).

Introduction

The incidence, etiology and management of ischemic stroke in young individuals are well-defined in Caucasian populations¹⁻⁵. However, such data is scanty from South East Asian countries. The etiologic classification of stroke in the young has undergone diversification with the addition of new categories such as anti-phospholipid antibody syndrome and disorders of interatrial septum^{8,9}. Despite these new etiologies, extracranial vascular disease is still a major cause of ischemic stroke in young individuals^{6,7}. Although previous studies have stressed the increasing significance of carotid and vertebral arterial dissection in young stroke, however carotid stenosis continues to contribute significantly, the figure ranging from 10- 15% among different studies³.

The present study is part of a larger project at the Aga Khan University Hospital, Karachi. This project is evaluating the clinical spectrum, diagnostic techniques and the etiology of ischemic stroke in young patients. In the present study we aim to present the role of carotid doppler ultrasound in the management of young stroke patients in whom carotid stenosis is the suspected cause.

Methods

This study was conducted at the Aga Khan University Hospital in Karachi. We retrospectively reviewed the medical records and carotid doppler ultrasound (CDUS) reports of patients aged 15-45 years, admitted with a diagnosis of ischemic stroke between November 01, 1992 to October 30, 1997. A total of 118 cases met the inclusion criteria. Among these, 45 patients underwent carotid doppler imaging. Investigations were performed on a case by case basis, therefore not all patients underwent CDUS. Cerebral angiography was not performed due to financial and technical constraints. In all cases the

diagnosis of ischemic stroke was established by excluding intracranial hemorrhage on the basis of computerized tomographic (CT) scan.

The carotid imaging was performed with a Toshiba triplex ultrasound scanning machine, which combines B-mode with color flow imaging. The degree of stenosis was graded according to the criteria in Table 1.

Table 1. Doppler spectral analysis:

Diameter	ICA/CCA Peak	ICA/CCA	Peak	Peak
Stenosis%	systolic velocity	Peak	Systolic	Diastolic
	ratio	Diastolic	Velocity	Velocity
		Velocity	Ratio	
		Ratio	(cm/s)	(cm/s)
0-40	<1.5	<2.6	<110	<40
41-59	<1.8	<2.6	>120	<40
60-79	>1.8	>2.6	>130	>40
80-99	>3.7	>5.5	>250	>80-135
100 (Occlusion)	Unilateral damped flow in CCA; no flow or reversed flow proximal to ICA occlusion.			

The study variables for the present study included the primary abnormality picked up on CDUS e.g. ulceration or stenosis, the degree of stenosis (high-grade >70%, moderate 40-70% and low grade <40%), type of plaque (soft vs. calcified) and whether the site of abnormality corresponded to the clinical deficit. In addition we collected data regarding the age, sex, history of hypertension, diabetes, smoking, family history of heart disease, and presence of hypercholesterolemia in the carotid stenosis group, as well as for the overall group of patients. The data was analyzed using standard data base software, including FoxPro and Microsoft Excel.

Results

A total of 118 patients between the ages of 15-45 years were admitted with a diagnosis of ischemic infarct over a five-year period. The mean age was 38 years and males were pre-dominant with a sex ratio of 1.8:1. The risk-factor profile of the overall group of 118 patients was compared with the subgroup of fourteen patients harboring carotid stenosis. In the overall group, fifty-one patients (43.2%) had a past history of hypertension. Thirty-six patients (30.5%) had a history of diabetes. A family history of heart disease was present in 15 patients (12.7%). Twenty-five patients (12.2%) were

smokers. Hypercholesterolemia was found in 15 patients (12.7%).

In the subgroup with carotid stenosis, the risk factor profile was somewhat different. The mean age of patients with carotid stenosis was 37 years. Among the 14 patients with carotid stenosis, nine were males (64%) and 5 females (35.7%). Half of all patients were hypertensive (n=7, 50%) and five were diabetic (36%). Four patients had a family history of heart disease (29%) and four of them were smokers (29%) (Table 2).

Table 2. Comparison of Risk Factor Profile of the Overall Group (N = 118) Vs. the Subgroup With Carotid Stenosis (n = 14).

Risk Factors	Overall Group	Carotid Stenosis Group
	N (%)	N (%)
Hypertension	51 (43.2)	7 (50)
Diabetes	36 (30.5)	5 (35.7)
Hypercholesterolemia	15 (12.7)	10 (71)
Smoking	25 (21.2)	4 (28.6)
Family history of Heart Disease	15 (12.7)	4 (28.6)

The carotid doppler exam was performed in 45 of the 118 patients. Stenosis due to plaque of the common carotid/internal carotid was found in 14 of the 45 patients (31.1%). Information about degree of stenosis was available in 11 patients who underwent doppler imaging. The degree of stenosis as reported by the radiologist was mild (<40%) in five cases. Moderate stenosis (40-70%) was found to be present in 3 cases. High-grade stenosis (>70%) was found in 3 patients. The carotid doppler ultrasound was normal in 31 of the 45 patients (69%).

In all of these patients with carotid stenosis, the clinical deficit corresponded to the territory of the infarct.

The consistency and character of the plaque was also studied by CDUS. The plaque was found to be soft in 6 cases (43%) and calcified in 2 cases (14.3%). Information about the character of plaque was not available in 3 cases (21%).

Discussion

We present our experience with CDUS in 45 young stroke patients aged 15-45 years.

A substantial proportion of our patients had risk factors for atherosclerosis. In the overall series of 118 patients, 43% of patients had a history of hypertension, which compares with figures of 15-25% in young stroke patients from the western hemisphere³. Thirty percent of our patients were diabetic; this figure is much higher than the 5-10% incidence reported in western series³⁻⁵. The prevalence of other risk factors including smoking and family history of heart disease, was similar to that in previous studies.

We also studied the risk factors of atherosclerosis in the 14 patients found to have carotid stenosis. The

age and sex ratio of this group was similar to the overall group. The proportion of diabetics was also similar, but this group had a higher proportion of hypertensive patients (53% vs. 43%). The proportion of patients with hypercholesterolemia was also much higher in this subgroup compared with the overall population (71% vs. 12.7%).

The overall rate of carotid stenosis in the study group was 31%. This compares with rates of 10-25% reported from Sweden, Italy and the US¹⁻³. Atherosclerotic disease of large extra-cranial vessels has not been considered to be a major cause of ischemic stroke in previous reports^{1,2}. The high rate of carotid stenosis in this study corresponds with the increased prevalence of risk factors for atherosclerosis, and highlights the recurrent theme of atherosclerotic disease in this series.

The character of plaque was found to be soft in six cases and calcified in two cases. This corresponds to previous reports in adult stroke patients¹⁰.

In conclusion, this study provides important new information about the patterns of carotid stenosis, the role of doppler ultrasonography and the prevalence of risk factors for atherosclerosis in young stroke patients. This data highlights the importance of atherosclerosis as a major cause of stroke in young adults. The high prevalence of hypertension, diabetes and hypercholesterolemia may reflect a shift in disease patterns and points to the need for early prevention. It also provides physicians an impetus to use doppler ultrasonography more often as a diagnostic and management modality in patients suspected of harboring carotid stenosis. This may enable early treatment to make a significant impact on the natural history of this deadly disease.

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