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# Carotid atherosclerosis: Socio-demographic issues, the hidden dimensions

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## KEYWORDS

Carotid atherosclerosis;  
Egyptian population;  
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## Summary

**Background and purpose:** The effect of conventional vascular risk factors on carotid atherosclerosis had been reported in many studies. Little is known about social and demographic issues on the development of carotid artery disease among different populations. The aim of our study is to demonstrate the prevalence of carotid atherosclerosis among Egyptians and its difference in relations to other studies from industrialized countries.

**Methods:** We analyzed the data of 4733 Egyptian subjects who underwent extracranial carotid duplex scanning at the vascular laboratories of the largest tertiary referral hospital in Cairo from January 2003 to January 2008. Demographic and clinical data were correlated with ultrasound findings.

**Results:** Atherosclerotic carotid artery disease was present in 41% of the study population, significant and high grade disease detected in 2.5% of the study populations. Multivariate stepwise logistic regression analysis selected age, hypertension and diabetes mellitus and dyslipidemia as independent predictors of the presence of carotid atherosclerotic disease.

**Conclusion:** Hemodynamically significant extracranial atherosclerotic carotid disease is rare in Egyptians. Risk factors for carotid atherosclerosis are the same as in societies where carotid disease is more prevalent.

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## Introduction

Atherosclerosis is a major cause of ischemic stroke and a significant proportion of strokes are thromboembolic in nature, arising from atherosclerotic plaques [1]. Several studies have reported racial differences in the severity and distribution of carotid atherosclerosis [2]. In the United States

and Western communities, extracranial carotid artery disease was estimated to be responsible for 20–30% of strokes [3,4]. Little is known about the prevalence and distribution of carotid disease among the populations in the developing countries. This hampers preventive measures and promoted us to analyze extra cranial carotid duplex scans of a large sample of Egyptians.

## Aim of the study

This study aims to reveal the effect of social, demographic and geographical factors on the prevalence of carotid atherosclerosis among Egyptians.

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## Materials and methods

We conducted a retrospective study to analyze the clinical and duplex ultrasound data of 4733 subjects who underwent carotid artery duplex scans in the vascular laboratories of Cairo University Hospitals from January 1st, 2003, to January 1st, 2008. Cairo University Hospitals are the largest tertiary care center in Egypt. The following data were collected from each individual prior to ultrasound examination:

**Cardiovascular risk factors:** Age, Sex, Smoking, Hypertension, Diabetes Mellitus, Dyslipidemia and Obesity.

**Clinical presentation:** Subjects were classified into two groups

- (1) Symptomatic group: 758 (39.1%) with stroke or transient ischemic attacks.
- (2) Asymptomatic group: 1182 (60.9%) subjects. The causes of referral were routine check up or prior to coronary by pass graft.

### Carotid duplex scan

Carotid duplex scanning was performed by qualified vascular operators using Siemens Elegra and Philips HDI 5000 machine. A high-frequency (7–10 MHz) linear array transducer was employed to scan the carotid from the most proximal common carotid artery (CCA) to the internal carotid artery (ICA) as far as the mandible permitted. We used the examination protocol and interpretation according to the criteria published by Society of Radiologists in Ultrasound 2003 [5].

### Statistical analysis

Data were described as mean  $\pm$  standard deviation (SD), range, frequencies (number of cases) and relative frequencies (percentages). Comparative statistics were performed with Student's *t* test, Mann–Whitney *U* or  $\chi^2$  test as appropriate. Multivariate regression analysis was performed to detect independent predictors of carotid atherosclerosis and carotid stenosis. A probability value (*p* value) less than 0.05 was considered statistically significant. All statistical calculations were performed using Microsoft Excel version 7 and SPSS version 15 for MS windows (Statistical Package for the Social Science, SPSS Inc., Chicago, IL, USA).

### Results

We studied a total of 4733 subjects (3422 men, 1311 women; mean age  $55.96 \pm 12.3$  years; range 32–79). The carotid duplex findings were classified as normal, atherosclerotic or non atherosclerotic disease. Atherosclerotic carotid disease was present in 1940 subjects (41%) of the study populations (Table 1). Multivariate stepwise logistic regression analysis showed that age (odds ratio, OR 1.079, *p* value < 0.001), diabetes (OR 2.019, *p* value < 0.001), hypertension (OR 1.541, *p* value < 0.001), smoking (OR 1.835, *p* value < 0.001) and dyslipidemia (OR 2.073, *p* value < 0.001) were independent predictors of the presence of carotid atherosclerotic disease. Obesity Showed marginal significance but OR was

**Table 1** Results of carotid duplex scans.

Ultrasound finding	Number of subjects ( <i>n</i> = 4733)	Percentage
Normal	2784	58.8%
Atherosclerotic	1940	41%
Non atherosclerotic	9	0.2%

Fibromuscular dysplasia, arterial wall dissection, Aneurysm and Takayasu's arteritis.

**Table 2** Frequency of different degrees of carotid atherosclerosis among the study population.

Degree of carotid atherosclerosis	Number of subjects ( <i>n</i> = 4733)	Percentage
Intimal thickening	835	17.6%
<50%	983	20.8%
50–69%	81	1.7%
$\geq 70\%$	38	0.8%
Occlusion	3	0.06%

less than one (OR 0.800, *p* value 0.037). The degree of atherosclerotic carotid artery disease was categorized as intimal thickening only, <50% stenosis, stenosis from 50 to 69%, stenosis  $\geq 70\%$  and occlusion. High grade stenosis  $\geq 50\%$  representing 2.5% of our study populations (Table 2).

### Discussion

Racial differences are important factors in the severity and distribution of carotid atherosclerosis, e.g. people of South Asian origin have higher rates of cardiovascular disease and stroke than people of European origin, a finding that cannot be explained entirely by differences in conventional cardiovascular risk factors [6]. Egypt is the most populated nation in the Middle East and the second most populous on the African continent, with an estimated 80 million people. We conducted a 5-year survey study of 4733 Egyptians from January 2003 to January 2008 using extra-cranial duplex as a screening tool, in Cairo University Hospitals. High grade stenosis  $\geq 50\%$  represented 2.5% of our study populations. This prevalence of significant atherosclerotic Carotid disease found among our Egyptian subjects was much lower than that noticed in studies from developed Countries as America, Asia and Europe. The American Cardiovascular Health Study, examined 5441 community-dwelling people aged  $\geq 65$  years. Carotid stenosis  $>50\%$  was found in 7% of the men and 5% of the women [7]. The Suita Study in Japan detected extracranial carotid stenosis  $>50\%$  in 7.9% of the men and 1.3% of the women or 4.4% of all the subjects [8]. The German Berlin Aging Study, a population-based study of functionally healthy volunteers from 70 to 100 years of age, found 4% of  $\geq 75\%$  carotid stenosis among both men and women [9]. A recently published study from Pakistan, which is a transitional and developing country like Egypt, reported a frequency of carotid disease in the same order as we found in Egypt [10]. This discrepant prevalence of significant carotid atherosclerosis among Egyptians and residents

of developed countries raises a number of questions regarding the cause of this discrepancy. Are there any underlying hidden dimensions or unknown factors, whether nutritional, genetic, environmental or life style? Is the rate of intracranial atherosclerosis higher than extra-cranial disease? The true answer is still obscure, and only more studies and surveys, with the additional efforts undertaken by health authorities, can help elucidating and clearing this hidden issues. Obesity was surprisingly marginally significant against carotid atherosclerosis with OR 0.800 and a  $p$  value 0.037, which can be explained as a chance finding. We suspect that the Cairene lifestyle and nutrition are the major contributors to the lower prevalence of carotid disease in Egyptians. The geopolitical features of Egypt are a real challenge to researchers. The main dichotomy for Egyptian citizens is the demographical division into those who live in the major urban areas and the farmers in rural villages. Almost the whole population is concentrated along the banks of the Nile (notably Cairo and Alexandria). Many Cairo residents have moved only recently from farming lands to Cairo and few are overweight. However, walking through Cairo one can spot, especially among the younger people, many who are overweight; an emerging risk factor. The possibilities to shift to fast food habits in Cairo are increasing and getting abundant. Atherosclerosis among the next generations of Egyptians might be rising. This is a call for health authorities to perform population-based epidemiological studies, monitor the non-communicable diseases and invest into health education and prevention programs. Our study had some limitations; being not population-based compared to studies from developed countries; moreover, the study sample represents Cairo citizens with higher socio-economic level who have better access to health care facilities than those living in rural areas.

## Conclusion

The existence of conventional vascular risk factors among our populations is more or less the same like other industrialized countries, yet the prevalence of carotid atherosclerosis

is much lower. This reveals hidden factors which are still not discovered.

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