

Prevalence of Carotid Artery Arteriosclerosis among Patients Undergoing Coronary Angiography in National Institute of Cardiovascular Diseases, Dhaka

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Presence and extent of carotid atherosclerosis was evaluated by Duplex ultrasound study in 50 patients with ischaemic heart disease (IHD), admitted for coronary angiography (CAG) in National Institute of Cardiovascular Diseases (NICVD), Dhaka during the period of July 1998 to August 1999. There were 42 male and 8 female (M : F = 5.3:1). Mean age of the study population was 50.7 ± 10.4 (range 30-75 years). Carotid evaluation was done within 2-5 days before or after CAG. Coronary artery disease (CAD) was present in 31 (91.2%) patients with carotid atherosclerosis but was absent in 3 (8.8%) patients. Among patients without carotid lesion, CAD was present in 9 (56.3%) and absent in 7(43.8%) cases. The difference was statistically significant (p<0.01). On the other hand, among CAD patients, carotid atherosclerosis was found in 31 (77.6%) patients and carotid lesion was absent in only 9 (22.6%) patients. Among those with normal coronary artery, carotid artery lesion was found normal in 7 (70%) cases only. The difference was also statistically significant (p < 0.01). Patients with normal and single vessel disease on CAG had carotid atherosclerosis in only 38.9% cases but patients with multivessel disease had carotid lesion in 84.4% of cases. Statistically, the difference was highly significant (p<0.001).

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Introduction

Cardiovascular diseases are the most common cause of death and disability in industrialized countries and emerging as the major cause of death and disability in developing countries like Bangladesh. Atherosclerosis is the main factor leading to myocardial infarction or stroke.¹ Epidemiological and clinical studies have shown that good association exist between severity of atherosclerotic disease in one arterial bed and involvement of other vessels.² Cohort studies have shown an increased risk of cerebrovascular diseases (CVD) in individuals with signs and symptoms of coronary artery disease (CAD) compared to non-affected individuals.^{3, 4} Symptoms and sign of CVD particularly transient ischaemic attack (TIA), carotid bruit and completed stroke also identified in individuals with a greater than normal likelihood of developing a coronary event.^{4,6} Ischaemic stroke has been

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found to develop in approximately 2-5% of patients in the first 1-2 weeks after myocardial infarction.^{7,8} Population based observational study using high resolution ultrasonography to estimate presence of carotid atherosclerosis showed that presence of any atherosclerotic findings in the common carotid artery or carotid bulbs was associated with relative acute myocardial infarction (AMI) hazards of 3 folds and the presence of small or large plaque in the same area showed a 4 fold size of AMI compared to subjects free of these manifestation of carotid atherosclerosis of the baseline.⁹ Thus non-invasive evaluation of carotid atherosclerosis can be used to predict coronary atherosclerosis and coronary events. So this study was done to see the prevalence of carotid artery atherosclerosis among patients with CAD undergoing CAG.

Methods

The study populations were 50 patients with coronary artery disease (CAD) who underwent coronary angiography (CAG). After obtaining informed consent the patients were asked to participate an ultrasound evaluation of carotid arteries. Details of history and findings of physical examination were recorded in a proforma. Patients with aortic valve disease were excluded. Blood glucose estimation (fasting and 2 hours post prandial) and fasting lipid estimation were done during admission for CAG. This procedure was performed by usual conventional method (percutaneous technique using either Judkins or multipurpose catheter). A 50% or greater luminal stenosis of a major coronary artery was defined as significant.¹⁰ CAD was classified as single, double or triple vessel disease. A left main stem stenosis was counted as two vessels. A double vessel or triple vessel or left main stem disease was leveled as multivessel CAD. Evaluation of presence of carotid atherosclerosis was done within 2-5 days either before or after CAG.

Presence and extent of carotid atherosclerosis were done by duplex ultrasound scanner HDI 3000 ultrasound system of ATL, Ultrasound Inc. Washington, USA. Selected scan head was a linear array having operating frequency range 5.0 – 10.0 MHz and Doppler frequency of 6.0MHz. The patients head position, sonographer position and scanning angle sequence were an standard. The extra-cranial carotid artery was evaluated at multiple levels Common carotid artery (proximal, mid and distal) carotid bulb, internal carotid artery (origin and proximal part) and external carotid artery (origin and proximal part). S-Mode imaging was done to 100 K for intimal thickening, irregularity and presence of plaque. Assessment of stenosis was done by analysis of special Doppler signal in cases where ultrasound study were done after the CAG examination.¹¹ Results of CAG were unknown to the sonographer. Results were analyzed statistically by using Student's t-test and chi-square tests. A p value <0.05 was considered significant.

Results

Baseline characteristics of the 50 participants are presented in table 1. There were 42 male and 8 female (F:M = 5.3:1). Mean age of the study population was 50.7 ± 10.4 years (range 30 - 75 years). Mean height of male was 1.6 ± 0.4 meters and that of female was 1.3 ± 0.3 meter. Mean weight of male and female were 62.2 ± 7.6 kg and 57.8 ± 7.6 Kg, respectively. The mean body mass index (BMI) was 26 ± 3.3 Kg/m². Twenty six patients (52%) of the study populations had history of myocardial infarction, 17 patients (34%) had chronic stable angina and 7 patients (14%) had unstable angina. History of transient ischaemic attack (TIA) was found in 10 patients (20%).

Table 2 summarizes the CAG funding of the study populations. CAG was normal in 20 percent cases and lesions were found in 80

percent cases. Among the patients with coronary lesions, 16 percent had single vessel disease, 26 percent had double vessel disease (figure 1) and 38 percent had triple vessel disease. Carotid B-Mode scans profile of the patients is shown in table 3. It reveals lesion in 34 patients (68%) and normal carotids in 16 patients (32%). Among patients with carotid lesion most of lesions were in common carotid and internal carotid artery. External carotid was less frequently involved. Ten patients with history of TIA revealed carotid Duplex abnormality. Among them 90% had intimal thickening and plaque with luminal stenosis and 10% had intimal thickening. Presence and absence of plaque among patients with history of TIA showed a statistically significant difference ($p<0.001$).

Table 4 summarizes the association of carotid atherosclerosis in patients with carotid atherosclerotic disease (CAD). Among 34 patients with carotid lesions CAD found in 31(91.2%) but was absent in 3 (8.8%). Among patients without carotid lesions, CAD was present in 9 (56.3%) and absent in 7 (43.8%) cases. A statistically significant difference ($p<0.01$) was found between the two groups. On the other hand, among patients with CAD, carotid atherosclerosis was found in 31 (77.5%) patients and carotid lesion was absent in only 9 (22.5%) cases. Among patients with normal coronary artery, carotid artery was normal in 7 (70.0%) cases and atherosclerotic changes were present in 3 (30.0%) cases only. Significant statistical difference was shown on comparison ($p<0.01$).

Among 8 patients with single vessel disease on CAG, carotid lesion was present in 4 (50.0%) patients. In 13 patients with double vessel disease, 10 (76.9%) had carotid lesion and 3 (23.1%) had no lesion. Among 19 patients with triple vessel disease 17 patients

(89.5%) had carotid atherosclerosis and only 2 patients (10.5%) had no carotid lesions.

Composite data analysis shows that a total of 7 patients (38.9%) with normal and single vessel disease had carotid atherosclerosis only but 27 patients (84.4%) with multivessel disease had carotid lesion. Statistically it shows a highly significant difference ($p<0.001$).

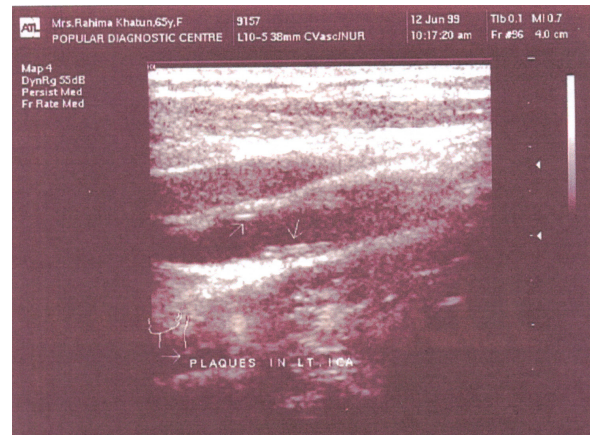


Figure 1. A 65 years old lady, presented with unstable angina. She was hypertensive and diabetic. CAG revealed double vessels disease. Carotid Duplex study showed, mixed plaque at proximal internal carotid artery (left) giving rise to about 22% diameter reduction.

Table I. Baseline characteristics of study population (n=50)

Characteristics	Findings
Age (mean ± SD yrs)	50.7± 10.35 yrs
Sex	
Male (%)	84%
Female (%)	16%
BMI (Mean ± SD; Kg/m ²)	26± 3.3
Clinical diagnosis of its(%)	
MI	52%
Chronic stable angina	34%
Unstable angina	14%

Table II: Coronary angiography (CAG) findings in the patients (n=50)

Variables	No. of patients (%)
Normal	10(20.0)
Coronary artery disease (CAD)	40 (80.0)
Single vessel disease	8 (80.0)
Double vessel disease	13 (26.0)
Triple vessel disease	19 (38.0)

Table III. Carotid B mode scan profile (n=50)

Variables	No. of patients (%)
Normal	16 (32.0)
Carotid Atherosclerosis	34 (68.0)
Intimal thickening with plaque	24 (45.0)
Intimal thickening only	10 (20.0)

Table IV: Association of carotid atherosclerosis and CAD (n=50)

CAD	Carotid Atherosclerosis		P value
	Present (%)	Absent (%)	
Present (n=40)	31(77.5)	9(22.5)	<0.01
Absent (n=10)	3(10.0)	7(70.5)	
Carotid atherosclerosis	CAD		P value
	Present (%)	Absent (%)	
Present (n= 34)	31 (91. 2)	3 (8.5)	<0.01
Absent (n=16)	9(56.3)	7 (43.8)	

Table V: Relationship between carotid atherosclerosis and severity of CAD (n=40).

CAD (Number of vessel involved)	Carotid Atherosclerosis	
	Present (%) (n=34)	Absent (%) (n= 16)
Single Vessel Disease (n=8)	4(50.0)	4(50.0)
Double Vessel Disease	10(76.9)	3(23.1)
Triple Vessel Disease	17(89.5)	2(10.5)

Discussion

Detection of severity of atherosclerosis of large superficial arteries has become easier due to development of high-resolution ultrasonography. Ultrasonography enables the measurement of wall thickness of superficial arteries; whereas, in angiography only lumen diameter can be assessed. Intima-media thickness of common carotid artery on ultrasonography has been recommended as a useful parameter to assess the presence of coronary artery disease in a publication of the American Heart Association.¹² Duplex ultrasound findings of carotid arteries showing elevated plaque score, increased number of plaques and degree of carotid stenosis were associated with higher risk of prevalent and/or incidence of coronary atherosclerosis, myocardial infarction or stroke.¹³⁻¹⁶

Noninvasive, safe, inexpensive and reliable method to assess atherosclerotic changes of large arteries located close to the skin such as carotid arteries is usually Duplex ultrasound study. In our study, detectable carotid arterial atherosclerotic changes were present in 88.2% of men and 11.7% of women in the cardiovascular health study. Detectable carotid stenosis was present in 75% of men and 62% of women.¹⁷ Carotid atherosclerosis (i.e. intimal thickening with or without plaque) was present in 68% of cases in this study which is almost similar to that observed by Khoury et al and Megien et al.^{16,12}

Out of 34 patients with carotid lesions 70.7% had intimal thickening with plaque and 29.4% had intimal thickening only. Atherosclerotic changes were present more in distal common carotid and origin of internal carotid artery and distribution was mostly bilateral. It was similar to the findings of Howards et al.¹⁹ Presence of carotid atherosclerosis among 30% of patients without CAD are comparable to that observed by Khoury et al. and

Megnien et al who found the same as 47% and 40% respectively.^{12,3} Among patients with CAD duplex study revealed presence of carotid atherosclerosis in 77.5% of the study population which is comparable to that described by Khoury et al and Megnien et al.^{16,18} Multivessel CAD was more strongly associated with carotid atherosclerosis than single vessel disease. A strong correlation between the extent of CAD and progression of carotid atherosclerosis was also found by Tanaka et al.²⁰ Crouse et al also found strong association between coronary status with mean intima-media thickness (IMT) at each of three carotid segments.¹⁰ Thus carotid duplex ultrasound findings of the present study correlate well with the previous similar studies done abroad although no comparable study has been done in our county.

Conclusion

Prevalence of atherosclerotic changes in carotid arteries detected by carotid duplex ultrasound among patients with CAD is remarkable. Carotid duplex ultrasound findings are also a good predictor of CAD and the procedure is non-invasive, safe and easily accessible for interrogation but still least practiced in our country. Meticulous carotid duplex ultrasound findings may be helpful to identify patients prone to develop stroke or coronary events.

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