Carotid Duplex Ultrasound Findings in Patients with Coronary Artery Disease (CAD)- A Study in 50 Cases

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Abstract

Background: Patients with angina pectoris or myocardial infarction are more likely to experience stroke. Ischaemic stroke has been found to develop in approximately 2-5% of patients in the first 1-2 weeks after myocardial infarction.

Methods: Fifty patients with coronary artery disease admitted to the National Institute of Cardiovascular Diseases (NICVD), Dhaka, were screened for presence of carotid atherosclerosis by duplex ultrasound study during the period of July 98 to August 98.

Results: Carotid lesion were found in 34 patients (68%) and normal carotids found in 16 patients (32%). Age range of patients with and without carotid lesions was 56±5.39 yrs and 47±7.91 yrs respectively. Out of 34 patients, 30 were male (88.2%) and 4 were female (11.7%). 29 patients (85.3%) were smokers, 22 patients (64.7%) were hypertensive and 9 patients (26.4%) were diabetic. Dyslipidaemia was found in 16 patients (47%) and a history of transient ischaemic attack (TIA) was found in 10 patients (29.4%). A coexistent CAD on coronary (CAG) was found in 31 patients (91.1%).

Conclusion: Carotid duplex ultrasound study findings of atherosclerotic lesions in Carotid arteries are good predictors of CAD.

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attack or stroke, simultaneous carotid endarterectomy and myocardial revascularization may be undertaken. In experienced hands stroke and mortality rates for combined treatment are less than 5%. In most other instances, myocardial revascularization precedes carotid endarterectomy. Which may be done weeks or years later, depending on symptoms. Thus this study was aimed to see the presence of carotid atherosclerosis in patients with CAD and its relation with severity of CAD. This procedure may be helpful to select subjects of CAD having concomitant carotid atherosclerosis. Management of both pathology may sometime be possible in the same setting.

Materials and Methods:
Presence and extent of carotid atherosclerosis were evaluated in a total of 50 patients of CAD with the help of 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 6.0 MHz. Carotid arteries were evaluated on both sides in usual standard planes at multiple levels e.g. Common carotid artery (CCA)-proximal, mid, distal; Carotid bulb; Internal carotid artery (ICA) - origin of ICA, proximal ICA; External carotid artery (ECA) - origin of ECA, proximal ECA.

The procedure included Doppler imaging, B-mode imaging (both with and without Doppler flow detection) and analysis of Doppler signal by spectrum analysis. B-Mode imaging was done to look for wall irregularities, intimal thickening and presence of plaque. Intimal thickening was considered when its thickness measured >1mm. A plaque (Localized areas of intimal thickening incorporating sufficient atheroma to develop plaque) was classified as follow:

1. Soft plaque-characterized by low amplitude intraluminal echoes without any acoustic shadowing.
2. Mixed plaque-characterized by greater reflectivity than soft plaque.
3. Hard plaque-characterized by high degree of reflectance and a persistent acoustic shadowing.
4. Intraplaque haemorrhage- characterized by cystic appearing lesion within or subjacent to a plaque. This lesion was believed to be the precursor of an ulcer.
5. Ulceration-usually associated with hard plaque and found to have an irregular appearance along the wall and base.
6. Occlusion-identified by visualization of echogenic material filling the arterial lumen and absence of Doppler velocity signals. Carotid arterial stenosis was assessed from diameter reduction measured by real time B- scan on a longitudinal plane. The plane that showed the smallest diameter was chosen and the residual diameter was measured using an electronic cursor.

All 50 patients underwent coronary angiography (CAG). Carotid evaluation was done within 2-15 days before or after CAG. Findings of CAG and carotid study were evaluated separately by at least two experienced specialists.

Statistical analysis was done by student’s t test and chi square tests. P-value<0.05 was considered significant.

Results:
Out of 50 patients 34 (68.0%) had carotid lesions and normal carotids were found in 16 patients (32%). Ten patients (20.0%) had intimal thickening only. Atherosclerotic plaque along with intimal thickening was found in 24 patients (48.0%).

Table-I

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of patients (%)</th>
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<tbody>
<tr>
<td>Atherosclerotic changes detected</td>
<td>34 (68.0)</td>
</tr>
<tr>
<td>Intimal thickening with plaque</td>
<td>24 (48.0)</td>
</tr>
<tr>
<td>Only intimal thickening</td>
<td>10 (20.0)</td>
</tr>
</tbody>
</table>

Of the 34 patients with carotid lesions, 30 (88.2%) patients were male and 4 (11.7%) were female. Mean age of those with carotid lesions was 56±5.39 yrs. average BMI of patients was 29.39±2.17. A history of TIA was found in 10 patients (29.4%). History of smoking was present 29 patients (85.3 %), hypertension was found in 22 patients (64.7%), diabetes mellitus (DM) was present among 9 patients (26.47%) and dyslipidaemia was present in 16 patients (47.06%). Coexistent coronary atherosclerotic findings on CAG was found in 31 patients (91.1 %)
**Table II**
*Characteristics of patients with carotid atherosclerosis (n=34)*

<table>
<thead>
<tr>
<th>Parameters</th>
<th>No of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H/o TIA</td>
<td>10(29.4)</td>
</tr>
<tr>
<td>Smoking</td>
<td>29(85.4)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>22(64.7)</td>
</tr>
<tr>
<td>DM</td>
<td>9(26.4)</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>16(47.0)</td>
</tr>
<tr>
<td>Coexistent CAD</td>
<td>31(91.1)</td>
</tr>
</tbody>
</table>

Among the patients with carotid lesions, most of the lesions were in common carotid artery (CCA) and internal carotid artery (ICA). Bilateral lesions were more common.

**Table III**
*Distribution of intimal thickening and plaque in different carotid arterial level (n=50)*

<table>
<thead>
<tr>
<th>Artery</th>
<th>Intimal thickening (%)</th>
<th>Plaque (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unilateral</td>
<td>Bilateral</td>
</tr>
<tr>
<td></td>
<td>Unilateral</td>
<td>Bilateral</td>
</tr>
<tr>
<td>CCA</td>
<td>9(18.0)</td>
<td>21(42.0)</td>
</tr>
<tr>
<td>ICA</td>
<td>4(8.0)</td>
<td>18(36.0)</td>
</tr>
<tr>
<td>ECA</td>
<td>4(8.0)</td>
<td>8(16.0)</td>
</tr>
</tbody>
</table>

**Discussion:**
The development of high-resolution ultrasonography of superficial large arteries has enabled the non-invasive assessment of the severity of atherosclerosis in man. Ultrasonography enables the measurement of wall thickness of superficial arteries whereas; in angiography only lumen diameter can be assessed. Intima-media thickness of the 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. 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 incident coronary atherosclerosis, myocardial infarction, or stroke.

Carotid duplex ultrasound study is commonly accepted as a noninvasive, safe, inexpensive and reliable method to assess the atherosclerotic changes of large arteries located close to the skin such as carotid artery. In our study, detectable carotid arterial atherosclerotic changes were present is 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. Carotid atherosclerosis (i.e. intimal thickening with or without plaque on duplex scan) was present in 34 (68.0%) cases in this study which is almost similar to that observed by Khoury et al and Megnien et al. Out of 34 patients with carotid lesion, 70.67% 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 Howard et al. 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. 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. Multivessel CAD was more strongly associated with carotid atherosclerosis than single vessel disease. A strong correlation between the extend of CAD and progression of carotid atherosclerosis was also found by Tanaka et al.
A strong association between coronary status with mean intima-media thickness (IMT) at each of three carotid segments was found by Crouse et al. 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 country.

Limitation of the study to be considered is that, this study was done on a selected group of patients, comprising small numbers in one hospital only.

Conclusion
Cortaid duplex ultrasound study findings of atherosclerotic lesions in Carotid arteries are good predictors of CAD. It identifies individuals most likely to have coronary atherosclerosis. The procedure is non-invasive, safe and easily accessible for interrogation. Early atherosclerotic changes detected by duplex study may be successfully prevented from further atherosclerotic occlusive lesions by measures like dietary advice, physical activity and lipid lowering therapy.

Reference: