Plasma Insulin and Carotid Intima Media Thickness in Hypertensive and Non Hypertensive Type 2 Diabetics

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Abstract

Diabetes mellitus and hypertension are two commonly co-existing diseases which are associated with evidence of endothelial dysfunction and atherosclerosis. Arterial IMT measured by high resolution B-mode ultrasound is a non-invasive indicator of the extent of generalized atherosclerosis. There is evidence that, at vascular level, carotid IMT is increased before the onset of diabetes type 2. Increased carotid IMT over a 2 years period was linked to age, LDL cholesterol and smoking but not to blood pressure levels. A few studies found no difference in IMT between hypertensive and normotensive subjects. On the other hand, many other studies demonstrated increased carotid IMT in hypertensive population more than normotensives. The purpose of our present study is to clarify the relation between carotid IMT as a predictor of atherosclerosis in hypertensive versus nonhypertensive diabetic patients. In this study, we examined 64 individuals. They were divided into 3 groups, 32 diabetic hypertensives, 22 diabetic nonhypertensives and 10 healthy individuals as a control group. High resolution B-mode ultrasonography (7.5 MHz) was carried out for all individuals under study 0.5 to 1 cm proximal to carotid bulb by a well trained sonographer.

Results: The mean value of IMT was 1.08 ±0.4mm for hypertensives and 0.85 ±0.2mm for nonhypertensive diabetic subjects (p<0.001), whereas, in control subjects, it was 0.4±0.06mm. A positive correlation was found between IMT and age in all patients (p<0.05) while, insignificant correlation was found between IMT and LDL cholesterol in all patients. Negative correlation was found between IMT and HDL in all patients. There was a statistically significant difference as regards fasting serum insulin in hypertensive Vs nonhypertensive diabetics with a mean value of 11.8 ±9.5u/L for hypertensive and 9.4±8.6u/L for nonhypertensives (p<0.005).

Key Words: Carotid IMT – Hypertensive – Nonhypertensive – Diabetics.

Introduction

The prevalence of hypertension in the diabetic population, is 1.5-3 times higher than that of non-diabetic age matched groups.

In type 2 diabetes, hypertension may be present at the time of diagnosis or even before the development of hyperglycemia.

Approximately 20-60% of patients with type 2 diabetes will develop hypertension, depending on age, ethnicity and obesity [1,2]. In the presence of diabetic nephropathy, the pathogenesis of hypertension is due to high both extracellular fluid volume and total body sodium and reduced activity of the renin-angiotensin aldosterone system and the hypertension is thus volume-dependent.

In the absence of diabetic nephropathy, other factors must play a role in the development of hypertension. These factors are both genetic and acquired. Elevated total body sodium with low or normal activity of the RAAS has been reported.

Moreover, hyperinsulinemia may possibly be associated with increased renal sodium resorption and sympathetic nervous system overactivity.

Insulin resistance is also associated with decreased vasodilatory response to insulin in skeletal muscle and increased vasoconstrictor vasopressors and hypertension has already been reported as a state of insulin resistance [3].

The main determinants of IMT in type 2 diabetic patients were related to both postglucose insulin levels and abnormal lipoprotein profile characteristics.

The increased carotid intima-media thickness in patients with type 2 diabetes mellitus was related to the presence of peripheral arterial disease. This finding probably reflects morphologic and hemodynamic similarities between the two vascular beds and indicates that increased carotid intima-media...
thickness in patients with type 2 diabetes may be a marker of atherosclerosis in different locations [4].

Ultrasound measurements of intima media wall thickness in the carotid artery have proved to be a useful predictor of coronary and cerebrovascular atherosclerotic diseases [5].

Increased common carotid IMT is associated with the prevalence of angina pectoris, myocardial infarction, and lower extremity arterial disease [6].

Moreover, several studies have shown a fair correlation of carotid IMT with angiographically verified coronary artery disease [7].

The aim of work was to study the carotid intima media thickness in hypertensive versus non hypertensive type 2 diabetes.

Subjects and Methods

In this study we classified 64 individuals into 3 groups, 32 diabetic hypertensives, 22 diabetic nonhypertensives and 10 healthy individuals as a control group.

Detailed history and complete physical examination. Smoking history was coded as never or current smoker. Examination included the BMI, examination of carotid and peripheral pulses, cardiac chest abdominal and neurological examinations. Laboratory investigations included high density, low density lipoproteins, serum triglycerides, fasting and 2 hours post prandial blood sugar, fasting serum insulin and HbAIC. Electrocardiography was done to all patients.

High resolution B mode ultrasonography (7.5MHz) readings were carried out by trained and certified sonographer. Three determinations were conducted on each side and the average measurement was used for IMT. Examination was done while patients in supine position and elevation of chest by pillow. Patients head turned to the apposite side of examination about 0.5 to 1 cm proximal to carotid bulb.

Results

There was a statistically significant increase in IMT in hypertensive Vs nonhypertensive diabetics with a mean value of 1.08±9.5u/L for hypertensives and 0.9±8.6u/L for nonhypertensives (p<0.005).

A positive correlation was found between IMT and LDL cholesterol in all patients.

There was a statistically significant difference as regard fasting serum insulin in hypertensive Vs nonhypertensive diabetics with a mean value of 11.8±9.5u/L for hypertensives and 9.4±8.6u/L for nonhypertensives (p<0.005).

Table (1): Mean values and of hypertensive versus non hypertensive diabetic patients.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hypertensives (32 patients)</th>
<th>Non hypertensives (22 patients)</th>
<th>Controls (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F plasma glu (mg/dl)</td>
<td>187.4±71.3</td>
<td>223.2±73.4</td>
<td>95.9±14.67</td>
</tr>
<tr>
<td>PP plasma glu (mg/dl)</td>
<td>264.1±57.1</td>
<td>282±103.5</td>
<td>113.7±9.53</td>
</tr>
<tr>
<td>S. triglycerides (mg/dl)</td>
<td>171.3±60.9</td>
<td>204.7±137.3</td>
<td>78±48.78</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>206.7±52.4</td>
<td>188.9±39.9</td>
<td>76.5±26.3</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>137.8±27.5</td>
<td>120.9±23.5</td>
<td>30±16.42</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>34.5±15.4</td>
<td>38.6±22.9</td>
<td>33.8±13.01</td>
</tr>
<tr>
<td>Mean IMT (mm)</td>
<td>1.08±0.4</td>
<td>0.85±0.2</td>
<td>0.4±0.06</td>
</tr>
<tr>
<td>Serum insulin (mu/ml) 20 patients</td>
<td>11.8±9.5</td>
<td>9.4±8.6</td>
<td></td>
</tr>
<tr>
<td>Body mass index (%)</td>
<td>28.5±1.6</td>
<td>28.2±1.4</td>
<td>25±1.3</td>
</tr>
<tr>
<td>Age (year)</td>
<td>56.4±9.4</td>
<td>50.6±17.3</td>
<td>52±7.1</td>
</tr>
</tbody>
</table>

Fig. (1): Correlation between age and IMT in all cases.
Hypertension and diabetes commonly coexists. High blood pressure is about twice as frequent in people with diabetes as in those without. Moreover, there is strong evidence for an excess prevalence of intimal thickening and atherosclerotic lesions in both diseases. Furthermore, there appears to be a synergistic interaction between the two conditions, because individuals with both disorders are at a much higher risk of incurring coronary artery disease.

**Discussion**

Fig. (2): Correlation between HDL and IMT in all cases.

Fig. (3): Mean values and st. deviation of main IMT in HTN Vs non-HTN.

Fig. (4): Fasting serum insulin in HTN Vs non-HTN.

Fig. (5): Carotid intima media thickness of the right and left common carotid arteries.
Diabetes mellitus is associated with thickening of the carotid wall and increased frequency of carotid plaques which is larger in type 2 than and even increases before the onset of diabetes type 2 [4,8].

Intima media thickness was found to be higher in hypertensive subjects significantly when compared with normotensives [9].

The increased carotid intima-media thickness in patients with type 2 diabetes mellitus was related to the presence of peripheral arterial disease. This finding probably reflects morphologic and hemodynamic similarities between the two vascular beds and indicates that increased carotid intima-media thickness in patients with type 2 diabetes may be a marker of atherosclerosis in different locations [4].

Increased common carotid IMT is also associated with the prevalence of angina pectoris, myocardial infarction [6].

Moreover, several studies have shown a fair correlation of carotid IMT with angiographically verified coronary artery disease [7].

Moreover, epidemiological studies have found that an increase of 0.1mm in maximum common carotid IMT was associated with 11% increase in the risk of myocardial infarction [5].

Ultrasound measurements of intima media wall thickness in the carotid artery have proved to be a useful predictor of coronary [8] and cerebrovascular atherosclerotic diseases [7] with significantly increased risk of stroke in established type 2 diabetes even, independent of blood pressure [10].

Our results showed a statistically significant increase in IMT in hypertensive Vs nonhypertensive diabetics with a mean value of 1.08±0.4mm for hypertensives and 0.85±0.2mm for nonhypertensives (p<0.001).

Adikkappan et al. [9] reported that carotid arteries among the vessels that are prone to develop overt atherosclerotic lesions in the presence of risk factors such as cigarette smoking, hypertension, dyslipidemia and diabetes mellitus, he also reported that, atherosclerotic plaque starts to develop in the carotids at approximately the same time in aorta, preceding the plaque occurrence in coronary arteries. Hypertension could cause atherosclerosis through a number of possible mechanisms such as enhanced monocyte and lymphocyte adherence to the endothelium and migration into intima, stimulated growth factors and cytokines proliferation, increased plaque cellularity, increased vascular oxidative stress and increased hypoxia caused by increased diffusion distance due to intimal and medial thickening.

The main determinants of IMT in type 2 diabetic patients were related to both postglucose insulin levels and abnormal lipoprotein profiles characteristic.

Our results showed a statistically significant difference as regard fasting serum insulin in hypertensive Vs nonhypertensive diabetics with a mean value of 11.8±9.5u/L for hypertensives and 9.4±8.6u/L for nonhypertensives (p<0.005).

Homma et al. [11] showed that the intima-media layer thickens linearly across the life span from young adults. Liz Andrea Villela et al. [12] reported higher values in males and older patient.

Moreover, in population based study it was proved that the increase of IMT was between 0.08-012mm/10 years [13].

Our results showed a positive correlation was found between IMT and age in all patients (p<0.05) insignificant correlation was found between IMT and LDL cholesterol in all patients.

Conclusion:

Carotid intima media thickness is increased in hypertensive than nonhypertensive diabetics, so, hypertension must be properly controlled in diabetics to reduce the added vascular risk. Moreover, Doppler ultrasound examination of carotid arteriers seems to be essential in management of diabetic complications. It is not clearly known to what extent, increased IMT could increase the vascular risk and influence coronary vessels and whether increased carotid IMT could change the risk stratification for asymptomatic subjects.

More detailed study on larger sample size and correlation with other vascular risk factors, microalbuminuria, ankle brachial index and coronary angiography may be of value.

References


