The relation of age, sex, smoking, body mass index to carotid intima-media thickness in patients with type II diabetes mellitus

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Microvascular and macrovascular complications are the most important causes of the mortality and morbidity in patients with diabetes mellitus. Atherosclerosis is the main mechanism in the genesis of those complications. The diabetes itself causes a risk for atherosclerosis and diabetics may also own a high incidence of other risk factors for atherosclerosis. Thickening of the intima-media complex in great vessels is the first morphologic feature of the atherosclerosis. Thickness of the carotid intima-media serves as an indicator of the carotid atherosclerosis. On the other hand, it gives a useful information about atherosclerotic course at the other regions, too. We evaluated common carotid arteries, because aorta and its branches are the first region which are affected by atherosclerosis and it can be examined easily and non-invasively by B-mode ultrasonography. In this study, we investigated the relation of the age, sex, smoking and body mass index to the thickness of the carotid intima-media complex in 79 non-insulin-dependent diabetics. We disclosed a positive correlation between the thickness of the carotid intima-media complex and age, duration of diabetes, and body mass index. Gender and smoking habit was not correlated with the thickness of the carotid intima-media complex. In conclusion, the thickness of the carotid intima-media complex can be claimed as a parameter of the atherosclerotic status of diabetics. So, we may recommend that carotid ultrasonography should be performed routinely in all diabetics. [Turk J Med Res 1997; 15(2):77-80]

Key Words: Diabetes mellitus, Atherosclerosis, Carotid artery intima-media thickness

Diabetes mellitus is a heterogeneous primary disorder of carbohydrate metabolism with multiple etiologic factors that generally involve absolute or relative insulin deficiency or insulin resistance or both. Non-insulin-dependent diabetes mellitus (NIDDM) may be the most rapidly growing chronic disease in the world. Its long-term complications, including retinopathy, nephropathy, neuropathy, and accelerated macrovascular disease causes major morbidity and mortality. Atherosclerosis is the main mechanism in the genesis of the microvascular and macrovascular complications. The diabetes itself causes a risk for atherosclerosis and diabetics may also own a high incidence of other risk factors for atherosclerosis.

Nonenzymatic glycosilation of the proteins play an important role in the genesis of macrovascular complications. Other factors, such as increased oxidative modification of the lipoproteins, dyslipidemia and hyperinsulinemia also can facilitate the development of the macrovascular complications (1-3).

Diabetic macrovascular complications occur gradually and insidiously during course of the disease, and they can be described as accelerated atherosclerotic events. Myocardial infarction, cerebrovascular events or peripheral arterial occlusions in the range of claudication to lower extremity amputation, all of are undesirable outcomes of macrovascular disease (4).

Because of the aorta and its branches are the first regions affecting from atherosclerosis, thickness of the carotid intima-media is a good indicator for atherosclerotic progression. Thus, thickness of the carotid intima-media is also gives useful information about atherosclerotic course of the other regions (5-7).

The purpose of our study is to determine the relation of age, sex, smoking and body mass index to carotid intima-media thickness (IMT) and to establish whether the IMT is an useful parameter for evaluating peripheral vascular disease or not.

MATERIALS AND METHODS

This study was carried out between October 1995 and July 1996, and included 79 patients with non-insulin dependent diabetes mellitus (NIDDM). Patients whose fasting blood glucose higher than 140 mg/dl were accepted as diabetic. Those patients have been treated either by oral antidiabetic drugs or insulin. Diabetic patients were accepted as NIDDM according to these criteria:

1- Onset of symptoms after age 30.

2- Positive family history of diabetes mellitus.

3- Clinical background of onset of diabetes.

Patients who were receiving hypolipidemic drugs or calcium channel blockers were excluded from our study.

Carotid ultrasonography (CUS) were performed to all patients with Acuson 128 XP /5 US, before determination of clinical risk factors and complications. Carotid artery was visualised both in transverse and longitudinal planes. In images made in the longitudinal plane, the intima-media complex was seen as a hyperechogenic line separated by the pair of parallel echogenic lines. Distance between the hyperechogenic lines measured as the IMT. Measurements were done from far-wall of common carotid and 2 cm proximal to bulb. Three measurements (anterolateral, lateral and posterolateral) were done for each common carotid artery, and mean of these values accepted as IMT.

Following CUS, detailed medical history including age, family history of diabetes, duration of diabetes, medications, smoking, symptoms of coronary heart disease were taken and patients underwent complete physical examination.

The data processed by computer using SPSS (Statistical Program for the Social Sciences, Release 6.00). Stem-and-leaf plot was used for the normal probability analysis. Results were compared by using a two-sample t-test, variance analysis and Mann-Whitney U test.

RESULTS

Patient group consisted of 47 females (mean age 64.4 ± 9.5 years (range 48 to 88)) and 32 males (mean age 59.7± 6.8 years (range 48 to 70)). The mean age of the all patients were 62.5± 8.8 years (range 48 to 88). Patient distribution according to risk factors presented in Table 1.

Sixty-eight percent of patients were at the age of 55 to 74 years old. 74.7% were non-smoker. BMI was in the range of 25 to 30 kg/m^2 in 45.6% of patients. Duration of diabetes was longer than 15 years in 32.9% of patients.

Mean IMT of left and right common carotid arteries according to age groups were shown in Table 2.

Correlations between age groups and mean IMT of both right and left common carotid were statistically significant (p<0.05, p<0.05). IMT values were found as higher at older ages. Figure 1 shows IMT values and ages, the lines upward related to aging.

Mean IMT of right and left common carotid related to gender presented in Table 3.

Table 1. Patient distribution according to risk factors

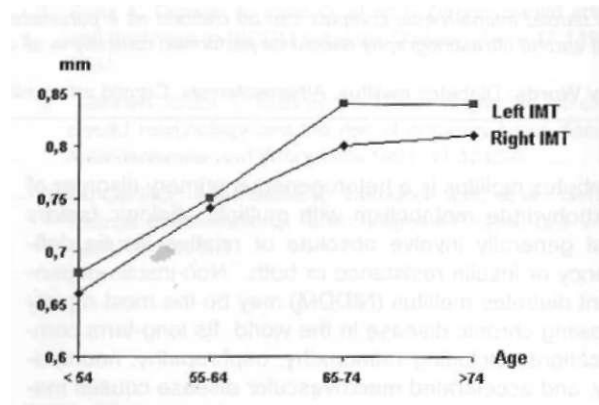| Risk factors	Number of patient (n)	%
Age		
45-54	19	24.1
55-64	27	34.2
65-74	27	34.2
>75	6	7.6
Smoking habit		
Smoker	20	25.3
Non-smoker	59	74.7
Body Mass Index (kg/m^2)		
<25	27	34.2
25-30	36	45.6
>30	16	20.2
Duration of diabetes (year)		
<5	17	21.5
5-10	21	26.6
10-15	15	19.0
>15	26	32.9

Figure 1. IMT values of common carotids and ages

There were no statistically significant differences between the mean IMT values of the male and female patients (p>0.05).

Correlations between smoking habits and mean IMT of right and left common carotid were statistically insignificant (p>0.05, p>0.05) (Table 4).

Table 2. Mean IMT of left and right common carotid arteries according to age groups

	IMT of right common carotid			IMT of left common carotid		
Age groups	Mean + SD	Khi-square	P	Mean + SD	Khi-square	P
<55	0.66 + 0.13			0.68 + 0.11		
55-64	0.74 + 0.14			0.75 + 0.13		
65-74	0.80 + 0.13			0.84 + 0.14		
>74	0.81 + 0.04	14.4	<0.05	0.84 + 0.08	19.1	<0.05

Table 3. IMT of right and left common carotid related to gender.

Gender	IMT of right common carotid			IMT of left common carotid		
	Mean + SD	t	p	Mean +_SD	t	p
Male	0.74 + 0.16			0.77 + 0.15		
Female	0.75 + 0.13	-0.11	> 0.05	0.77 + 0.13	-0.11	>0.05

Table 4. Smoking habits and mean IMT of right and left common carotid

Smoking habit	IMT of right common carotid			IMT of left common carotid		
	Mean + SD	t	p	Mean + SD	t	P
Smoker	0.76 + 0.20			0.77 + 0.17		
Non-smoker	0.74 + 0.12	-0.37	> 0.05	0.77 + 0.13	-0.14	> 0.05

Table 5. Mean IMT of right and left common carotid related to body mass index.

BMI (kg/m²)	IMT of right common carotid			IMT of left common carotid		
	Mean + SD	Khi-square	P	Mean + SD	Khi-square	P
<25	0.68 + 0.14			0.70 + 0.12		
25-30	0.79 + 0.13			0.80 + 0.13		
>30	0.75 + 0.14	4.43	<0.05	0.80 + 0.15	5.7	< 0.05

Table 6. Duration of diabetes and carotid IMT

Duration of diabetes	IMT of right common carotid			IMT of left common carotid		
	Mean + SD	Khi-square	P	Mean + SD	Khi-square	P
< 5 years	0.63 + 0.03			0.66 + 0.02		
5-10 years	0.67 + 0.02			0.70 + 0.03		
10-15 years	0.78 + 0.02			0.78 + 0.02		
> 15 years	0.86 + 0.02	34.0	<0.05	0.90 + 0.02	41.4	O.05

As shown in Table 5, there were statistically significant differences between mean IMT of right and left common carotid and BMI (p<0.05 and p<0.05).
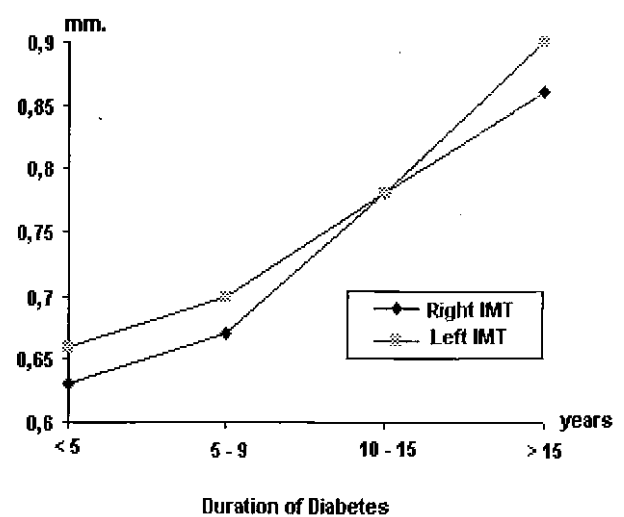
The relation of duration of diabetes to carotid IMT presented in Table 6.

The comparisons of the duration of diabetes and both left and right common carotid IMT were statistically significant (p<0.05 and p<0.05).

Figure 2 shows IMT values and duration of diabetes, the lines upward related to progression of diabetes.

DISCUSSION

Macrovascular complications play the most important role in the increment of mortality in diabetic patients and they can be described as an accelerated atherosclerosis. Thickness of the intima-media complex in large vessels is a first evidence of atherosclerosis. Thus, measurement of IMT is an useful method to establish the athero-

Figure 2. IMT values of common carotids and duration of diabetes.

sclerosis at subclinical stages. This measurement can be performed easily from common carotids by using B mode US.

The correlation between atherosclerotic risk factors and carotid IMT had been widely examined. But the duration of diabetes, gender, BMI and carotid IMT had not been examined before. So, we have designed this study.

In our study, we found that common carotid IMT increases with the age. Pujia et al reported a close correlation between age and common carotid IMT in patients with diabetes mellitus (6). However, these findings may be related to older ages of patients that, the same correlation had been established in patients without diabetes by Weller et al (7).

There were no statistically significant differences between gender and IMT. Those results were concordant with the increased cardiovascular mortality and morbidity in diabetic females. In nondiabetic population, insulin sensitivity is higher in females, thus the cardiovascular risk factor profile is better in females. However, with the onset of diabetes in female patients, insulin sensitivity much more decreases than diabetic males and cardiovascular risk also becomes greater (8).

IMT values were similar in smoker and non-smokers in our study. Pujia et al found minimal effect of smoking on IMT in diabetics. This effect may be result of hypoxia and endothelial injury due to cigarette (6).

A positive relationship was found between duration of diabetes and IMT. This result may be related to the progression of diabetes that causes to increment of glycosyl proteins. Pujia et al's findings were concordant with our results (6). However much, duration of diabetes is rarely related to coronary artery disease risk in NIDDM, so, it had been put forward by some authors that, hyperinsulinemia and duration of insulin resistance are sensitive markers for coronary artery disease. Glycosilation of collagen, laminin and fibronectin may induce matrix production and probably development of plaque (9).

In conclusion, the thickness of the carotid intima-media complex can be claimed as a parameter that can specify the atherosclerotic status of diabetics. So, we may recommend that carotid ultrasonography should be performed routinely in all diabetics.

Tip II diabètes mellitusta yaş, cinsiyet, sigara kullanımı ve vücut kitle indeksi ile karotis intima-media kalınlığı arasındaki ilişki

Diabetli hastalarda mortalité ve morbiditenin en önemli nedeni mikro ve makrovasküler komplikasyonlardır. Bu vasküler komplikasyonların gelişmesinde temel mekanizma aterosklerozdur. Diabetik kişilerde hem diabetin kendisi bir ateroskleroz risk faktörüdür, hem de diabetiklerde aterosklerozun diğer risk faktörleri daha sık görülmektedir. Büyük damarlarda intima-media kompleksinin kalınlaşması aterosklerozun ilk morfolojik belirtisidir. Karotis intima-media kalınlığı hem karotis aterosklerozu için bir gösterge, hem de diğer bölgelerdeki ateroskleroz için bir habercidir. Çalışmamızda karotis arterinin seçilmesinin nedeni ateroskleroza ilk tutulan damarların aort ve dalları olması ve bu arterin B mod US ile kolayca ve non-invaziv bir şekilde görüntülenebilmesidir. Çalışmamızda, 79 NIDDM'li hastada ateroskleroz ile ilişkili olan yaş, cinsiyet, vücut kitle indeksi (VKİ), diyabet yaşı ve sigara içiminin karotis intima-media kalınlığı arasındaki ilişkiyi inceledik. Karotis İMK'nın hastaların yaşının artmasıyla ve vücut kitle indeksinin artışı ile arttığını oysa cinsiyet, sigara içimi ile farklılık göstermediğini tesbit ettik. Bu sonuçlara göre, karotis İMK diabetik kişilerde kişinin ateroskleroz açısından durumunu belirlemede kullanılabilir bir parametredir ve bu sonuçlarla biz tüm diabetiklere rutin olarak karotis US yapılmasını öneriyoruz. [T Klin Araştırma 1997; 15(2):77-80]

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