



Comparison of Carotid Intima-media Thickness in Hypertensive Patients and Control Group

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ABSTRACT

Background: Hypertension (HTN), probably, is the most common public health problem among developed countries. Rapid diagnosis and effective treatment of HTN have not truly stopped the rapid rate of mortality and morbidity caused by HTN. Vascular wall changes are one of the most important and mortal complications of HTN. Ultrasonography was used for the evaluation of this vessel wall disorder by assessing the thickness of the intima and media layer. **Objective:** The objective of this study was to compare the Carotid intima Media Thickness (CIMT) in hypertensive patients and the control group. **Methods:** In a case-control study, 43 patients with documented primary HTN and 43 healthy subjects were assessed as control. Their HTN was controlled by the administration of drugs. The mean age was 53.9 years. The intima-media thickness (IMT) of internal and common carotid and outer vessel diameter were assessed by one radiologist. **Results:** CAIMT in all carotid arteries in the case group was more than that of the controls ($P < 0.05$). It was found that there was no difference between the length of having HTN and mean CAIMT in the hypertensive, except the right internal carotid ($P = 0.024$). **Conclusion:** The present study found that the mean CAIMT of all carotid arteries in HTN was more than that of the controls. Moreover, the duration of the HTN can accelerate the atherosclerosis process in hypertensive patients.

Key Words: Atherosclerosis, carotid intima-media thickness, hypertension, ultrasound

INTRODUCTION

Cardiovascular diseases are the most common causes of death in the world. In Iran, these diseases are ranked first as the leading cause of mortality.^[1] Hypertension (HTN) is the most common cause of visiting physicians and one of the most prevalent cardiac risk factors; and if properly diagnosed and controlled, it is possible to prevent serious complications such as ischemic heart disease, heart failure, stroke, and renal failure.^[2]

The arterial capacity in resistant artery is a decisive factor of arterial pressure. In hypertensive patients, functional, mechanical, and structural changes cause a decrease in the diameter of arteries. These changes increase systolic pressure, pulse pressure, and stiffness of arteries.^[3]

In current studies, arterial stiffness is dealt with as an independent predisposing factor for cardiovascular accident; there are different processes to assess systemic regional stiffness. One of the valuable techniques in the estimation of carotid artery stiffness is ultrasonography.^[4]

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Ultrasonography is a cheap, easy, and noninvasive method through which intima-media thickness (IMT) is measured.^[4] Various studies have been conducted to measure IMT in diabetics, obese patients, and patients with renal diseases and dyslipidemia.^[5,6]

Since racial, geographical, and cultural differences are decisive in both HTN and IMT, it was decided to carry out a comparative study of IMT in HTN and healthy individuals in Birjand in 2010.

METHODS

The present case–control study was conducted in Birjand, Imam Reza Hospital in 2010. The cases were 43 primary hypertensive patients who had suffered the condition, at least, for 5 years. Their hypertensive condition was controlled by the administration of drugs. The patients were selected from those referred to the cardiology wards of Vali-e-asr Hospital. The controls were selected from patients referred to other clinics of the Vali-e-asr Hospital.

The controls were healthy and did not have a history of HTN. The two groups (i.e., cases and controls) were matched regarding age and sex. The subjects gave their consent by writing and entered the study, after being justified. The exclusion criteria included diabetes, renal disease, secondary HTN, dyslipidemia, cardiac or cerebral disease, and cigarette smoking.

The blood pressure (BP) of members of both groups was taken while they were in the sitting position, applying the right hand by means of a mercury sphygmomanometer. The BP of every one was consecutively taken twice, at an interval of 10 min in-between, and the average pressure obtained was recorded as BP.

Weight (W) and height (H) were measured using standard methods, and body mass index (BMI) was calculated on the basis of the following formula: BMI = weight (kg)/height (m²).

A research-designed checklist consisting of demographic information was filled out, for each subject, by the researcher. Then, both group members were referred to a radiologist for the measurement of carotid IMT (CAIMT).

An ultrasound linear probe with 8 MHz resolution (Medison Tech Company, South Korea) was used for measuring the CAIMT.

Finally, the obtained data were analyzed using the SPSS software, SPSS, Inc, Chicago, IL, USA, at a significance level of $\alpha < 0.05$.

RESULTS

In the present study, 43 primary HTN patients whose conditions were under control and 43 healthy individuals, after being matched with respect to age and sex, were compared regarding CAIMT.

Table 1 presents the demographic information of the patients. As it is evident in the table, mean serum glucose and lipid in both groups were the same, but mean BMI of the case group was significantly higher than that of the control.

The mean CAIMT in both groups is compared in Table 2. According to the table, the mean CAIMT in all carotid arteries in the case group was more than that of the controls.

Table 1: Demographic data

Variable	Group		
	Case (n=43)	Control (n=43)	P
Mean age (year)	53.9±8.1	53.9±10	0.99
Male (%)	35 (81.4)	32 (74.4)	0.44
Fasting blood sugar (mg/dl)	90.1±6.4	100.2±8.1	0.32
Cholesterol (mg/dl)	160.7±21.4	154.8±34.7	0.39
Triglyceride (mg/dl)	125.9±35.6	115.3±29.8	0.15
High-density lipoprotein-cholesterol (mg/dl)	50.1±12.75	49.3±10.9	0.51
Low-density lipoprotein-cholesterol (mg/dl)	112.9±23.3	107±18.5	0.19
Body mass index	29.1±4.1	25.3±3.5	<0.001*

*Significant

Table 2: Carotid intima-media thickness in two groups

Carotid intima-media thickness	Group		
	Case	Control	P
Right internal	0.48±0.08	0.5±0.07	0.026*
Right common	0.58±0.1	0.62±0.08	0.031*
Left internal	0.5±0.66	0.46±0.08	0.009*
Left common	0.61±0.8	0.56±0.1	0.023*

*Significant

Table 3: The carotid intima-media thickness according to the duration of the disease

Carotid intima-media thickness	Duration of hypertension		P
	5-10 years (n=21)	≥ 10 years (n=21)	
Right internal carotid	05±0.06	0.53±0.07	0.024
Right common carotid	0.61±0.08	0.07±0.64	0.22
Left internal carotid	0.5±0.05	0.51±0.07	0.4
Left common carotid	0.6±0.08	0.63±0.08	0.21

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The mean CAIMT in HTN, regarding length of having the disease, is shown in Table 3. It was found that there was no difference between the length of having HTN and mean CAIMT in the hypertensive patients.

DISCUSSION

HTN is one of the serious risk factors of cardiac diseases and it causes the death of about 50% of patients with coronary artery diseases and heart failure, if untreated.

Increasing CAIMT is an independent risk factor and a measurable one in the diagnosis of subclinical atherosclerosis. In the present study, a comparative study of CAIMT in controlled primary HTN and in healthy individuals was dealt with, and CAIMT was found to be directly related to age.^[5] However, the mean CAIMT is higher than that of women of the same age. However, after menopause, the rate of CAIMT increase is more in women.^[5] This was why the patients were matched regarding age and sex in the current study.

The present study found that mean CAIMT of all carotid arteries in HTNs was more than that of the controls. In Tachiuchi's study, 25 normotensives and 140 HTNs were assessed. The aim of the research was to study the relationship between cardiac flow reserves (CFRs) and CAIMT. Results indicated that the CFR was significantly less in the HTN and there was a reverse relationship between CAIMT and CFR, but the common CIMT was a strong and independent parameter in the prognosis of CFR in HTN.^[6]

In his study, Sasaki compared the CAIMT of 163 untreated primary HTN and that of 76 normotensives. It was found that CAIMT in the patients was significantly higher than that of the controls and in both groups, there was an increase in age. The results of this study are similar to those of the present one.^[7] According to Sasaki, vascular remodeling is the cause of carotid arterial changes. In the early atherosclerosis stages, a compensatory mechanism prevents narrowing coincident with an increase in IMT, which occurs during the early phase. Although it is a compensatory mechanism, hemodynamic changes still occur in the walls of the arteries resulting in arterial disease.^[7]

In his study, Chironi compared IMT in the right common carotid in 394 healthy individuals with that of 327 uncontrolled HTN and 528 controlled HTN. The results of the study showed that CAIMT in both patient

groups, not accounting for any treatment, was higher than that of the healthy group.^[8] The present study which was only conducted on treated HTN had similar results.

Based on our study, the right and left common and internal carotid arteries in HTN was significantly higher compared to healthy individuals.

In Andrew's study on 6975 individuals aged 19–90 years, it was found that the mean development of IMT in the internal carotid was significantly higher in comparison with that of the common carotid and carotid bifurcation spot. This study proved that only the IMT of the common internal carotid had a significant relationship with arterial risk factors such as age, sex, HTN, diabetes, and smoking.^[9]

In the study of Liang *et al.* on 372 smokers and 307 hypertensive nonsmokers, CAIMT was measured. The obtained data showed that both smoking and HTN increased IMT; but HTN, by itself, increased the IMT/Lumen ratio, while smoking had no effect on this ratio.^[10]

On the basis of the present study, no relationship was observed between the length of HTN and IMT; something that may be due to the fact that all our patients had, at least, a history of 5 years of HTN.

CONCLUSION

IMT in the carotid arteries of HTN is more than that of healthy individuals. This condition can be a sign of subclinical atherosclerosis.

Limitation

The main limitation of the study was the small number of samples, although patients were matched in regard to age, sex, and heart risk factors; and at least, they had a hypertension history of 5 years behind.

It is noteworthy that the present study was done in the cardiology ward of the Vali-e-asr Hospital. Patients from all parts of the city were referred to this ward.

The second limitation was that the hypertension was in a more obese state, since obesity has a relationship with CAIMT; if the two groups (case and control) had the same BMI, the situation would have been better.

The last limitation of the present study was that medical treatment administered to hypertension was not taken into account.

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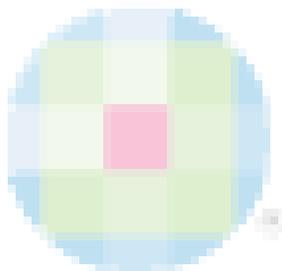
Nil.

Conflicts of interest

There are no conflicts of interest.

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