ORIGINAL ARTICLE

Correlation of Carotid Artery Intima Media Thickness with Anthropometric Parameters in Young Healthy Individuals

S. R. Tankhiwale

Dattatraya Hambire

— Dept. of Medicine, J.N. Medical College, Wardha, Maharashtra.

Abstract

"Correlation of Carotid Artery Intima Media Thickness with Anthropometric Parameters in Young Healthy Individuals" included 200 young individuals. The mean age was 22.2 years and male to female ratio was 3:2. The mean height was 164 centimetres, mean weight was 61.14 kg and mean BMI was 22.4 kg/m$_2$. In the study population 10% individuals were underweight, 20% were overweight & 21% were obese using the WHO Asian classification of BMI. The mean WHR was 0.85. The CIMT ranged from 0.4 to 0.7 mm with mean CIMT being 0.56 mm.

Introduction

Atherosclerosis is a major cause of death and premature disability in society[1]. Many risk factors like increasing age, male sex, postmenopausal state, obesity, smoking, positive parental history, hypertension, Diabetes Mellitus and dyslipidemia predispose to its development.

A non-invasive technique, that is the measurement of Carotid Artery Intima Media Thickness (CIMT), has recently generated considerable interest as a marker of atherosclerosis[2,3].

The mean CIMT was found to increase linearly with[4-7]

Various studies have investigated the association of carotid artery IMT with risk factors of atherosclerosis in asymptomatic young healthy adults, such as age, weight, gender, BMI, and WHR. Increasing age, obesity and BMI are associated with increased carotid artery IMT values in young healthy individuals [8-11]. This indicates that these asymptomatic individuals have a greater risk of developing atherosclerotic vascular disease in future life.

With this background the present study was undertaken to measure carotid artery IMT as a measure of atherosclerosis in young healthy asymptomatic adults, and the same was correlated with various anthropometric parameters in these individuals.

Materials & Methods

The present study entitled "The correlation of Carotid Artery Intima Media Thickness with Anthropometric

weight, from 0.4 mm for those subjects between 31-40 kg to 0.7 mm for those between 91-100 kg which was statistically significant. Higher WHR (> 0.91) was associated with a significantly higher CIMT. The mean CIMT was 0.50 mm in cases with BMI of < 18.5, and was 0.53, 0.57 & 0.63 in cases with BMI of 18.5-23, 23.1 to 25 & above 25.1 respectively. This difference was statistically significant. Correlation of CIMT with height on the other hand was not statistically significant. All otherwise apparently healthy individuals who are overweight, obese, or who have a high WHR may have their CIMT estimated periodically for early detection of atherosclerosis.

Keywords

Carotid Artery Intima Media Thickness (CIMT), Anthropometric Parameters

Address for correspondence: S. R. Tankhiwale, 110, Shivaji Nagar, Nagpur - 440 010.

Parameters in Young Healthy Adults" was carried out in the Department of Medicine, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha over a period of 24 months from October 2005 to October 2007.

Candidates of both sexes studying in Datta Meghe Institute of Medical Sciences University campus, Wardha, were selected randomly and included in the study after valid informed consent.

The study is a cross sectional analysis consisting of a cohort of 200 young healthy adults between 18-30 years of age. Subjects who were taking cardioactive drugs like antihypertensive agents, anti-dyslipidemic agents etc., as also those who had history of steroid use were excluded. Those cases with history of Diabetes Mellitus or evidence of Impaired Glucose tolerance, history of thyroid, renal, renovascular or peripheral vascular disease were also excluded. Candidates who had hypertension and obesity were not excluded from the study.

The various anthropometric parameters were evaluated in all subjects. These included measurement of height in meters, weight in kilograms, estimation of body mass index, waist circumference and hip circumference.

Body Mass Index (BMI) was calculated using the formula

$$BMI = \frac{\text{Weight in Kilograms}}{\text{Height in metres}_2}$$

The Waist-Hip Ratio (WHR) was calculated using the formula

$$WHR = \frac{\text{Waist circumference (cm)}}{\text{Hip circumference (cm)}}$$

Candidates were classified as underweight when BMI was < 18.5, normal if BMI was 18.5 to 23, overweight when BMI was 23.1 to 25, and obese if BMI was > 25.1 using the WHO Asian classification of BMI_{12}.

General and systemic examination was carried out in all subjects to search for evidence of any cardiac disease, cardiac failure, COAD or Atherosclerosis.

Carotid Artery Intima Media Thickness (CIMT) was evaluated by Carotid Artery Doppler on both sides by B mode Ultrasound using TOSHIBA Logic 400 MD scanning machine with 8 MHZ linear Array superficial flow for USG with the candidate in supine position. The ultrasonographic image of the arterial wall is that of two parallel echogenic lines separated by a hypoechogenic space. The distance from the leading edge of the first echogenic line to that of the second is the combined thickness of Intima Medial Layers i.e. Intima Medial Thickness.

After recording various anthropometric measurements and carotid artery IMT in all cases, an attempt was made to correlate age, sex, height, weight, BMI and WHR with carotid artery IMT by using one way analysis of variance, chi-square test and student's t-test, and the results thus obtained were interpreted.

Results

The study included 200 healthy individuals of either sex. The mean age of the cases was 22.2 years and male to female ratio was 3:2.

In the present study, 10% of subjects had a height of 141 – 150 cm, 23% had a height ranging from 151 – 160 cm; most subjects, i.e. 38% had their heights in the range of 161-170 cm, while 29% had height of > 170 centimeters.

The weight of the subjects varied from 38 kg to 96 kg. Weight was 31 – 40 kg in 2 % of subjects (n = 4), between 41-50 kg in 27 % subjects (n = 54), 51-60 kg in 25 % cases (n = 50), 61 – 70 kg in 22 % subjects (n = 44). In 24 % cases (n = 48) weight was above 70 kg.

The body mass index distribution showed that 13% cases were underweight (BMI < 18.5), 20 % were of normal weight with a BMI of 18.5 – 23, 20% cases were overweight (BMI 23.1 - 25) and 21% cases were obese (BMI > 25.1), using the WHO Asian classification of BMI.

The Waist Hip Ratio (WHR) was 0.71-0.8 in 29 % cases, in 48 % cases it was 0.81-0.9 and it was 0.91-1.0 in 23 % cases.

The Carotid Artery Intima Media Thickness (CIMT) was studied in all 200 cases. It was 0.31 to 0.4 in 3 % cases, 0.41 to 0.5 in 28 % cases, 0.51 to 0.6 in 49 % cases & 0.61 to 0.7 in 20 % cases.

The Correlation Studies:

The mean CIMT was 0.54 in age group of 16-20 & 21-25 years of age, while it was 0.66 in age group of 26-30 years of age. This difference was statistically significant.

Table 1
Correlation of age with carotid artery IMT

Age group (Yrs)	No. of cases	Mean IMT	F – value	p – value
16-20	62	0.54	19.68	0.00 S p < 0.05
21-25	114	0.54		
26-30	24	0.66		

In the present work, males had a significantly higher CIMT as compared to females (0.57 versus 6.54 mm).

Table 2
Correlation of sex with carotid artery IMT.

Sex	No. of cases	Mean IMT	t –value	p – value
Male	102	0.57	4.85	0.03 S p < 0.05
Female	98	0.54		

It was observed that there was a steady increase in CIMT with increasing weight. This was statistically significant.

Table 3
Correlation of weight with carotid artery IMT

Weight	No. of cases	Mean IMT	F –value	p – value
31-40	4	0.42	10.78	0.00 S p < 0.05
41-50	54	0.53		
51-60	50	0.53		
61-70	44	0.55		
71-80	30	0.60		
81-90	10	0.67		
91-100	4	0.70		

The mean CIMT was 0.50 mm in cases with BMI of < 18.5. The values of CIMT were 0.53, 0.57 & 0.63 in cases with BMI of 18.5-23, 23.1 to 25 & above 25.1 respectively. This difference was statistically significant.

Table 4
Correlation of BMI with carotid artery IMT.

BMI	No. of cases	Mean IMT	F – value	p – value
< 18.5	26	0.50	18.17	0.00 S p < 0.05
18.5 – 23.0	92	0.53		
23.1 – 25.0	40	0.57		
25.1 & above	42	0.63		

The WHR was correlated with CIMT. It was observed that mean CIMT was 0.51 with WHR of 0.71-0.8. It was 0.56 mm with WHR of 0.81 to 0.9 and the same was 0.60 with WHR of 0.91 to 1.0. This was statistically significant

Table 5
Correlation of waist hip ratio with carotid artery IMT.

Waist hip ratio	No. of cases	Mean IMT	F – value	p – value
0.71 – 0.8	58	0.51	11.27	0.00 S p < 0.05
0.81 – 9.0	96	0.56		
0.91 – 1.0	46	0.60		

Discussion

The present work entitled "Correlation of Carotid Artery Intima Media Thickness with Anthropometric Parameters in Young Healthy Individuals" included 200 young individuals. The mean age was 22.2 years and male to female ratio was 3:2.

The mean height was 164 centimetres, mean weight was 61.14 kg and mean BMI was 22.4 kg/m_2. In the study population 10% individuals were underweight, 20% were overweight and 21% were obese using the WHO Asian classification of BMI. The mean WHR was 0.85. The CIMT ranged from 0.4 to 0.7 mm with mean CIMT being 0.56 mm.

The mean CIMT was 0.54 mm in the age group of 16-

20 & 21-25 years of age while it was 0.66 mm in the age group of 26-30 years. This difference was statistically significant. Ishizu *et al*[13] demonstrated a linear increase in mean CIMT with increasing age. Bradshaw *et al*[14] also confirmed that age is a major predictor of atherosclerosis, based on increased CIMT in young asymptomatic individuals. Syn *et al*[15] stated that age is an independent risk factor for atherosclerosis. The values of CIMT were higher in males as compared to females in the present work. Male gender is associated with higher CIMT valves in various studies & Jorma *et al*[16] noticed two times higher regression coefficients in males versus females.

The mean CIMT in those with a height in the range from 141-150 mm was 0.52 mm. This increased progressively to mean CIMT of 0.57 mm in the tallest subjects (range from 170 cm – 180 cm). However the difference was found to be statistically insignificant in the present study. Frost *et al*[17] had found an inverse correlation between height & CIMT, whereas Tilling *et al*[8] found a linear correlation of height with CIMT.

The mean CIMT was also found to increase linearly with weight, from 0.4 mm for those subjects between 31-40 kg to 0.7 mm for those between 91-100 kg. This was statistically significant. These findings are similar to those of Sorot *et al*[18] & Davis *et al*[19]. On the other hand, Frost *et al*[17] did not find a correlation of weight with CIMT.

In the present study, those subjects whose BMI was above normal, i.e. those who were overweight and obese, had a significantly higher CIMT than those with a normal BMI. Stabouli *et al*[20] noticed similar findings. Jourdan *et al*[21] found a correlation for BMI with both carotid IMT & femoral artery IMT. Oren *et al*[22] had found BMI to be an independent determinant of CIMT in young adults. Similar findings were noted by Pauletto *et al*[23], Ciccone *et al*[4], Syn *et al*[15].

In the present study we also noted that a higher WHR (> 0.91) was associated with a significantly higher CIMT. Davis *et al*[17] in their study of young subjects also found the same association of WHR with CIMT. Ciccone *et al*[4] also noticed a similar correlation between CIMT & WHR.

To summarize, in this study we noticed that the mean CIMT had a direct linear correlation with weight, BMI & WHR; correlation of CIMT with height on the other hand was not statistically significant. In view of these findings we recommend that all apparently healthy individuals who are overweight, obese or who have a high WHR may have their CIMT estimated periodically for early detection of atherosclerosis.

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