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Carotid Intima Media Thickness Percentiles for Pakistani Population

Waseem Mirza¹, Mubashir Aslam Arain², Arif Ali², Vaqar Bari¹, Mirza Kazim Ali¹ and Kainat Fatima¹

ABSTRACT

Carotid artery intima media thickness estimation is a well-established way of cardio vascular disease evaluation. The purpose of this cross-sectional study was to develop normal carotid intima media thickness percentile values for a Pakistani cohort. Data was collected at the Departments of Radiology and Family Medicine, The Aga Khan University Hospital, Karachi, from April 2014 to August 2015. High frequency ultrasound of carotid was done in 257 patients [97 male (38%), 160 female (62%)] without any known carotid artery disease. Reference ranges (90% range between 5th and 95th centiles) were constructed for each common carotid and internal carotid artery measurement and displayed in graph form. The mean difference was found in left common carotid artery (0.55 ± 0.13) and left internal carotid artery thickness (0.50 ± 0.10) significant at $p=0.031$ and $p=0.014$, respectively. The IMT percentile graphs developed in this study for internal and common carotid arteries are exclusive for this population and can be used to assess vascular health from ultrasound measurements.

Key Words: Carotid intima media thickness. Ultrasound. Hypertension.

Carotid artery intima media thickness (CIMT) measurement is one of the best non-invasive parameters for evaluating the previous vascular damage. It is a surrogate measure of vascular atherosclerosis and represents vessel wall alterations over time, caused by different risk factors.¹ CIMT is highly associated with cardiovascular risk factors,² and robust predictor of cardiovascular outcomes and cerebrovascular complications.³⁻⁶ The measurement of CIMT has also been advocated and proposed as a non-invasive tool for cardiovascular risk assessment in primary prevention.⁵

B-mode ultrasound is the modality of choice for CIMT evaluation as it is accurate, safe, cost-effective and easily available. Various investigators have derived CIMT centiles for correct interpretation of normal reference values, but there is a paucity of literature for the South Asian population. Normal values of CIMT for Pakistani population have not been established. This study was reviewed and approved by the Hospital Ethics Committee. Ultrasound measurements were done in a standardized way by using electronic caliper installed in the ultrasound machine. CIMT was defined as a distance between the leading edge of luminal echo to the leading edge of the adventitia of the media. During periods of diastole, the image was frozen, and the

measurements were assessed 1cm proximal and distal to the carotid bulb on both sides.

Data was entered and analyzed by SPSS version 21. Mean \pm SD was calculated for continuous variables and frequencies and percentages were computed for categorical variables. Moreover, 10th, 25th, 50th, 75th and 90th centiles were computed for each common carotid and internal carotid artery measurement separately for male and female and line graphs were plotted (Figures 1 and 2). Independent t-test was used to check the mean difference between male and female with common carotid artery and internal carotid artery thickness. P-value <0.05 was considered as level of significance. Table I shows the mean difference between male and female with common carotid artery and internal carotid artery thickness. The mean difference of right common carotid artery thickness and right internal carotid artery thickness were insignificant ($p=0.599$ and $p=0.802$), respectively. The mean difference of left common carotid artery thickness and left internal carotid artery thickness were significant ($p=0.031$ and $p=0.014$), respectively.

All groups demonstrated age-related, arterial segment-specific distribution patterns for carotid IMT. Overall, there were lower values and fewer variations in female IMT between the age groups, which is more visible for left and right internal carotid arteries. Howard *et al.* also reported in their study that men had larger IMT than did women at all segments and all percentiles.³ Howard *et al.* demonstrated a similar pattern of IMT ranges for the American population,³ and Ciccone *et al.* developed IMT ranges for Italian population in CAMP study.⁶ Both studies used age and gender distribution to develop the normal range of IMT. These studies are recommended

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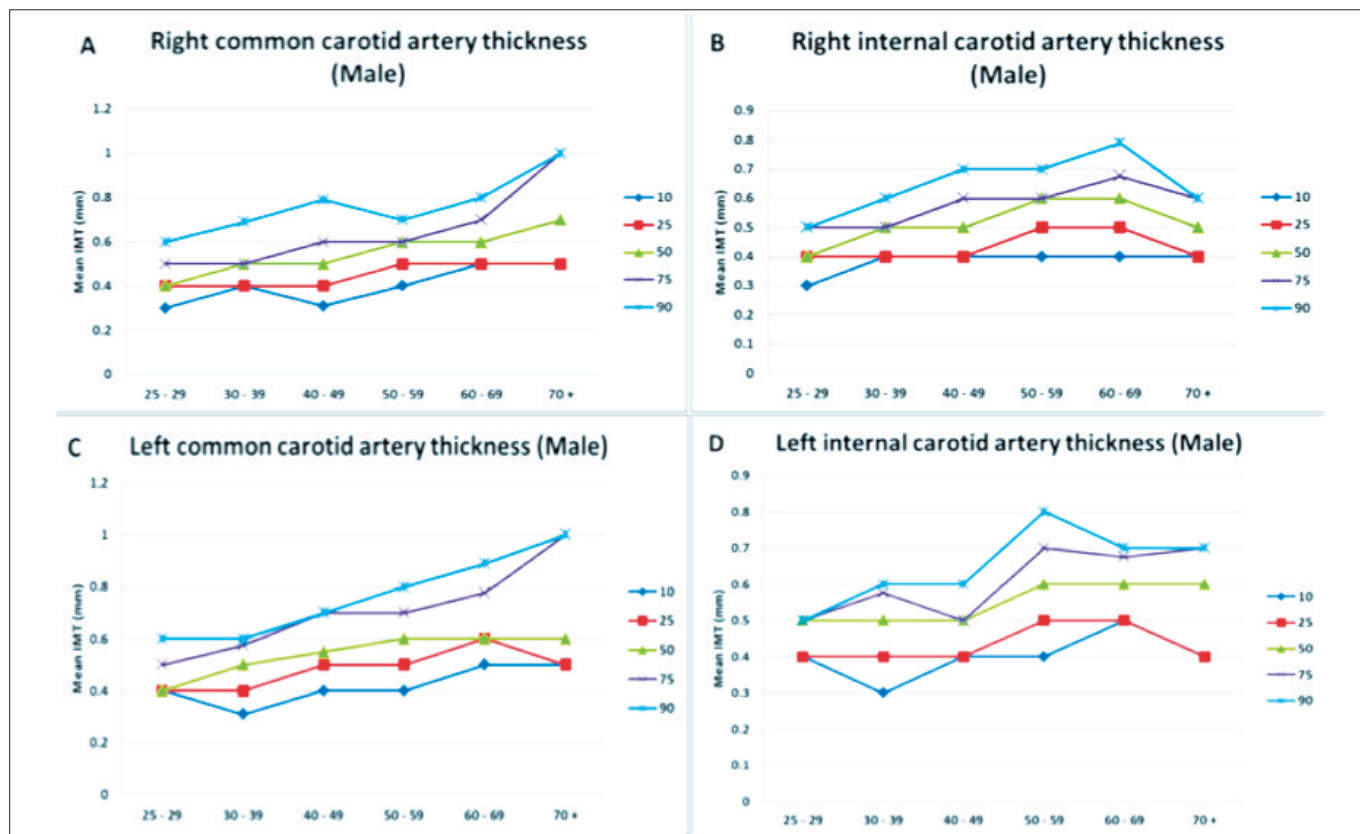


Figure 1: IMT changes in (A) right common carotid artery related to age (B) right internal carotid artery related to age (C) left common carotid artery related to age (D) left internal carotid artery related to age (men percentiles according to established age-range).

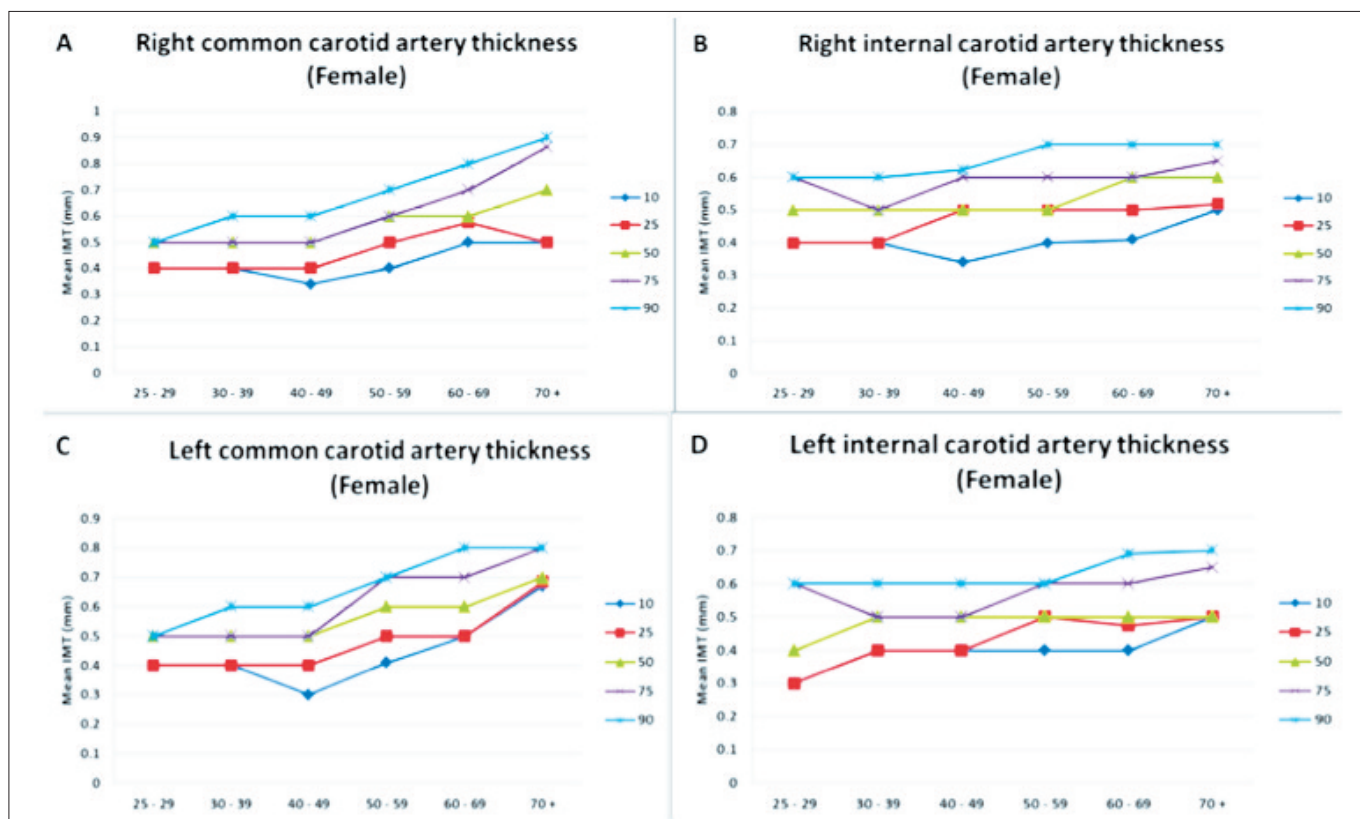


Figure 2: . IMT changes in (A) right common carotid artery related to age, (B) right internal carotid artery related to age, (C) left common carotid artery related to age, (D) left internal carotid artery related to age (female percentiles according to established age-range).

Table I: Mean common carotid artery thickness and internal carotid artery thickness between male and female.

Carotid artery thickness n (%)	Male 97 (37.74)		Female 160 (62.26)		Overall 257 (100)		T-test	
	Mean	SD	Mean	SD	Mean	SD	t-value	p-value
Right common carotid artery thickness in mm	0.5515	0.14150	0.5428	0.12076	0.5461	0.12878	0.526	0.599
Right internal carotid artery thickness in mm	0.5258	0.12100	0.5293	0.10199	0.5280	0.10933	-0.241	0.802
Left common carotid artery thickness in mm	0.5732	0.14543	0.5364	0.12368	0.5503	0.13323	2.163	0.031
Left internal carotid artery thickness in mm	0.5309	0.11934	0.4969	0.09751	0.5098	0.10733	2.367	0.014

the use of ultrasound as an excellent tool for detecting asymptomatic carotid alterations and patients at high risk for the cerebral and cardiovascular disease.

There were two important limitations to this study, firstly it is a small single-hospital-based study; and secondly some baseline characteristics of the patients like height and systolic blood pressure were not adjusted. The authors recommend future studies to look into the variations of the IMT ranges within different ethnic groups in Pakistan using a large population-based sample.

Disclosure: This study is a part of larger project named Carotid Artery Ultrasound and Vascular Atherosclerosis supported by seed money grant # PF12/1011 of Aga Khan University and published in Journal of Pakistan Medical Association.²

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