ORIGINAL COMMUNIATION

COMMON CAROTID INTIMAL MEDIAL THICKNESS IN A KENYAN POPULATION

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SUMMARY393

Carotid intimal medial thickness, a marker for early atherosclerosis, has high clinical utility. It shows gender, regional, age and ethnic differences but data from black African populations are scarce. This study describes the carotid intimal medial thickness in a black Kenyan population. One hundred and fifty histological samples from 25 males and 25 female left common carotid arteries were routinely processed for light microscopy and stained using Mason's Trichrome stain. The intimal medial thickness was measured on the photomicrographs using the Scion Multiscan software. The mean age of the cases was 28±19yrs. Mean carotid intimal medial thickness is higher in males (0.97±0.22) than females (0.77±0.06), p=0.05 and increases distally. Carotid intimal medial thickness increased with age being 0.5±0.16mm, 0.87±0.24mm and 1.21±0.36 mm for the age groups 0-20yrs, 21-40yrs and 41-60yrs respectively (p=0.035). Carotid intimal medial thickness in black Africans is similar to that reported for Caucasian populations. It is higher in males, increases distally and with age.

Key words: Carotid Intimal medial thickness, atherosclerosis

INTRODUCTION

The combined thickness of the carotid artery tunica intima and media (Carotid intimal medial thickness), has established predictive value for stroke and myocardial infarction. It is therefore valuable in cardiovascular disease risk stratification and primary prevention as a surrogate marker of atherosclerosis (Jarauta et al., 2010). It shows segmental, age, gender and ethnic differences, following relative distribution of cardiovascular disease. For example it is 1.049mm and 0.55mm in Americans and Nepalese respectively (Crouse et al., 1995; Sharma et al., 2009).

As atherosclerotic diseases become more common in black African populations, data on such surrogate markers of atherosclerosis are important to inform preventive strategies (Jarauta et al., 2010). Nonetheless, intimal medial thickness is hardly reported for black African populations. The present study describes the post-mortem carotid intimal medial thickness and luminal diameter in a Kenyan sample without known cardiovascular risk factors.

MATERIALS AND METHODS

Fifty left comm393on carotid arteries from 25 males and 25 females randomly selected from consecutive autopsies done on black Africans at the Department of Human Anatomy, University of Nairobi were used in this study. Ethical393 approval was granted by the Kenyatta National Hospital /University Of Nairobi ethical review committee. Individuals with noted premorbid cardiovascular risk factors as well as those with observable cardiovascular disease were excluded from

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the study. The fifty samples were divided equally into three age groups (0-20, 21-40 and 41-60 years). They were also divided into three segments, proximal (A), middle (B) and distal (C). The individual vessel segments were routinely processed for paraffin wax embedding and stained using Masson's Trichrome stain to show the general structure of the vessel. The slides were examined under the Leica microscope at different magnifications. Photomicrographs were taken using the Zeiss digital photomicroscope at magnifications of x40 and x100 for analysis. Analysis of the intimal medial thickness in the photographs was done using Scion Image™ Multiscan software (Scion Corporation, Frederick, Maryland) after calibration accurate to 0.01 mm, using ruler measurements of the histological slides (Nakashima et al., 2002). The collected data were analysed using the SPSS version 17 for Windows 7 for means. The ANOVA was used to determine significance. A p value of $P<0.05$ was considered significant.

RESULTS

The median age of study population was 28yrs, with the youngest sample was from a 1yr old while the oldest was 60 yrs old. Mean carotid intimal medial thickness was 0.86±0.22 mm. The mean proximal, middle and distal carotid intimal medial thickness were 0.86±0.26 mm, 0.84±0.28mm and 0.90±0.35 mm respectively [p=0.08]. Males had a thicker intimal medial thickness (0.97±0.22) when compared to females (0.77±0.06), [p=0.05].

Carotid intimal medial thickness increased with age; 0.5±0.16 mm, 0.87±0.24 mm and 1.21±0.36 mm for the age groups 0-20, 21-40 and >40 respectively [p=0.035] (Figure 1 and 2). The mean luminal diameter of the carotid artery was 4.52±1.33 mm. It was 4.51 mm, 4.53 mm and 4.52 mm in the proximal middle and distal segments respectively (p=0.06). The luminal diameter of the carotid artery increased with age. The percentage stenosis also increased with age; 16%, 19% and 21% for the age groups 0-20, 21-40 and >40 respectively (p=0.053).

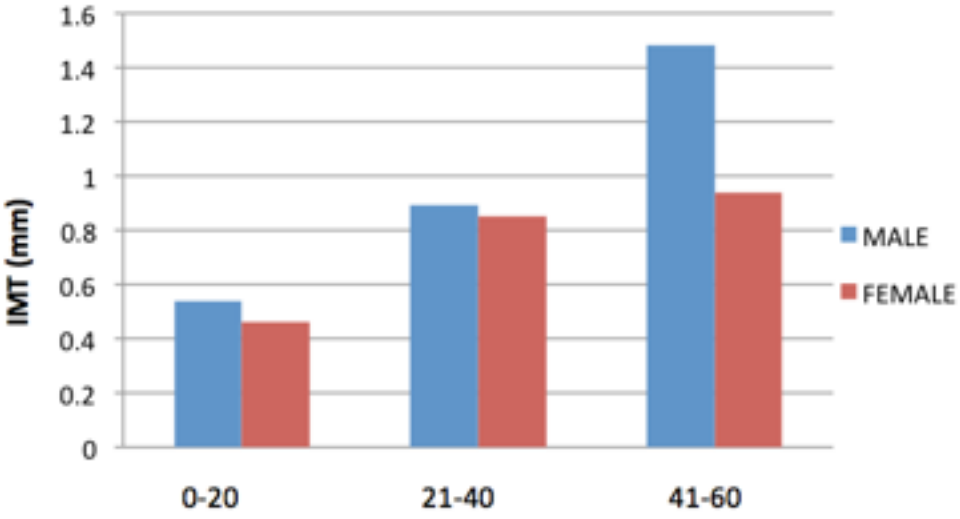

Figure 1: Intimal medial thickness in different age groups.

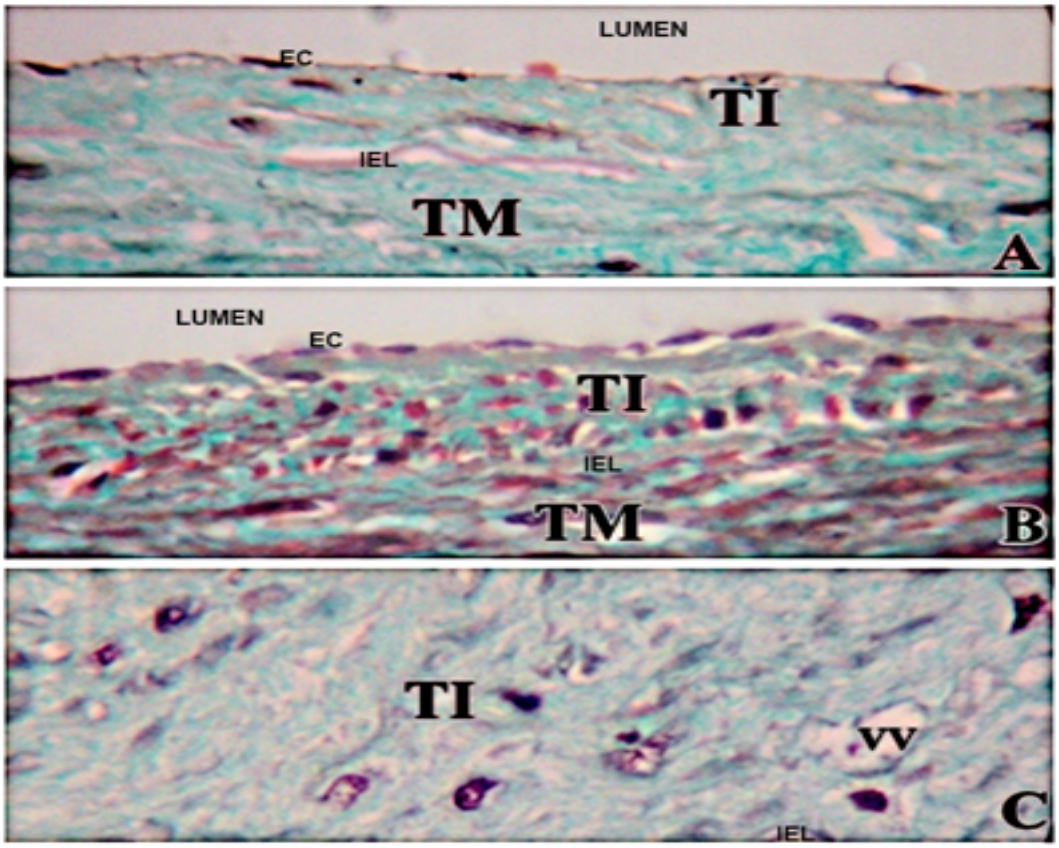

Fig 2: A photomicrograph showing the increase in the size of the tunica intima with age. Distal segments of the carotid arterial wall in 12 (A), 25 (B) and 50 (C) yr old females respectively. The size of the tunica intima increases with age. EC- endothelial cells; iel – internal elastic lamella, vv – vasa vasora, TI – tunica intima, TM – tunica media.

Table 1: Carotid Intimal medial thickness in various populations

Study	Population	Method	IMT (mm)
Crouse et al., 1995	US	ultrasound	1.049
Simons et al., 1999	Caucasian	Ultrasound	0.94
Okeahialam et al., 2011	Nigeria	Ultrasound	0.91
Bots et al., 2005	Netherlands		0.82
Adaikkappan et al., 2002	Indian	Ultrasound	0.73
Özdemir et al., 2006	Turkey	Ultrasound	0.62
Sharma et al., 2009	Nepalese	Ultrasound	0.55
Pignoli et al., 1986	Italian	Histology	0.48
Plavnik et al., 2000	Brazilian	Ultrasound	0.54
Present study	Kenya	Histology	0.86

DISCUSSION

The carotid intimal medial thickness of 0.86 mm found among Kenyans by histology closely compares with ultrasound results observed in Dutch and Nigerians [Table 1] (Bots et al., 2005; Okealahim et al., 2011). Although there is a difference in the methods used, Intimal medial thickness measured by ultrasound correlates significantly with the IMT determined by histology (Pignoli et al., 1986; Choi et al., 2009). The difference between the intimal medial thickness in the present sample and the 0.48 mm observed by Pignoli et al (1986) on microscopy is remarkable. Although there were similarities in sample preparation, differences exist in the sample size, segment, age and measurement method used. Pignoli evaluated 44 male as opposed to the 50 carotid samples used in the present study. Their samples aged between 20-25yrs while our samples ranged from 1-60 yrs. When adjusted for age and gender, CIMT in samples between 21-30yrs in the present study were 0.74 mm, still higher than the observations of Pignoli. Furthermore the CCA segments measured by Pignoli were unclear. Finally, Pignoli et al (1986) used a graduated ocular piece for measurement, while the present study used the Scion Image™ Multiscan software for intimal medial thickness assessment. It is however unclear as to whether methodology, ethnic, or lifestyle differences could explain this remarkable difference in IMT.

This thickness was lower than 1.049 mm reported in Americans and higher than 0.73 mm reported in Indians (Crouse et al., 1995; Adaikkappan et al., 2002). Intimal medial thickness in Kenyans was also lower than the 0.94mm reported in Caucasians, in contrast with earlier reports that IMT is significantly higher in blacks than Caucasians (Chambless et al., 1997; Urbina et al., 2002). Carotid intimal medial thickness shows population related differences, which are attributed to the distribution of cardiovascular risk factors in these populations. The IMT of the CCA is a good marker for both the presence of early arteriosclerosis (Pignoli et al., 1986) and the degree of arteriosclerosis of an individual (Simons et al., 1999). Increases in the thickness of the intima and media of the carotid artery are directly associated with an increased risk of atherosclerosis in other vascular beds such as the coronary arteries (Jarauta et al., 2010).

Carotid intimal medial thickness increased with age, supporting observations made in previous studies (Osika et al., 2009; Jarauta et al., 2010). The increased intimal medial thickness comprised more elastic lamellae, smooth muscle cells and size, and increased collagen deposition. Age changes in the structure of the carotid artery including diffuse intimal thickening develops from an early age in human arteries before atherosclerosis evolves (Nakashima et al., 2002; Nilsson et al., 2008). Changes in the structure of the carotid artery with age could be attributed to hemodynamic differences related to the variability of the carotid bifurcation with age (Goubergrits et al., 2002), as well as lifestyle changes in life (Okada et al., 2004). Individuals from adolescence should be encouraged to adopt cardiovascular friendly lifestyles to slow the effects of aging on the carotid artery, which would otherwise complicate into atherosclerosis later in life.

Carotid intimal medial thickness was higher in males (0.97 mm) than in females (0.77 mm), consistent with previous reports (Ebrahim et al., 1999). The observed higher intimal medial thickness in males begins from adolescence and partly explains why males are more prone

to atherosclerosis when compared to females (Bohm et al., 2009). Contrary to previous observations, the gender differences in the dimensions of the carotid intima and media were pronounced in the third age group in which the mean of 0.94mm and 1.48mm in females and males respectively (Sinning et al., 2011). Males in the third age group had unusually thick vessel walls compared to the females. This disparity could be in part related to the differences in the ethnic and age groups considered and our small sample size. Nonetheless postmenopausal women had increased intimal medial thickness, significantly more than their premenopausal counterparts. The age difference in the intimal medial thickness between the females in the third age group and the females in the second age group was comparable to the gender difference in the CIMT. This suggests that menopause is accompanied with significant increase in carotid intimal medial thickness in support of the observations made by Espeland et al (1995). The similarity in pattern of difference in the intimal medial thickness between the genders, and between the post-menopausal and premenopausal females generally also implies that females are masculinized after menopause. The gender difference in the structure of the vessel has been related to the effects of oestrogens and androgens.

In conclusion, carotid intimal medial thickness in black Africans is similar to that reported for Caucasian populations. It is higher in males and increases distally and with age.

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