



## Tobacco -- Smoking -- Atherosclerosis and Carotid Ultrasound

### KEYWORDS

Atherosclerosis, Smoking, tobacco, CIMT, CCA, IHD, CVE, Stroke

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### ABSTRACT

**Background :-** Previous studies have indicated an association between Cigarette smoking and increased risk of atherosclerotic disease in adults with or without clinical cardiovascular (IHD) and cerebrovascular disease (CVE, stroke). Previous studies have also shown that Carotid Intima Media Thickness (CIMT) reliably gives a fair idea of presence or absence of atherosclerosis in carotid artery itself and coronary arteries and cerebral arteries and arteries elsewhere in the body. Higher CIMT means more atherosclerotic burden in the body.

**Aim:-** The aim of this study is to describe the mean values of CIMT in all those subjects who are cigarette smokers or use tobacco in different forms and compare them in subjects who were non smokers or did not use tobacco in any form.

**Results:-** Mean CIMT was significantly higher (0.8727mm +- 0.22981mm) in those subjects who were cigarette smokers or used tobacco in different forms than in those subjects who were non- smokers or did not use tobacco in any form ( 0.7896mm +- 0.21539mm; P=0.002).

**Conclusion:-** The data of present study of local Indian population of low income group in and around Pune confirms the findings of previous studies in general population. Hence it has been found in the present study that CIMT values in subjects who are smokers or use tobacco in different forms in local Indian population of low income group are significantly higher ( P=0.002) than those who were nonsmokers or not using tobacco in any form in the same income group after adjusting for other risk factors for atherosclerosis like DM, HTN and for increasing age.

### Introduction :-

The high incidence of CVE and IHD in individuals with atherosclerosis is a well documented fact <sup>(1)(2)</sup>. Cigarette smoking or use of tobacco in all forms is known to be associated with higher risk of atherosclerosis which is an independent risk factor of CVE or IHD <sup>(3)</sup>. Atherosclerosis generally occurs all over the arterial tree in the body and more or less equally in coronary, cerebral and carotid arteries. Hence Carotid Intima Media Thickness (CIMT) measurement can give a fair idea of atherosclerosis in carotid arteries themselves and coronary arteries and cerebral arteries. Higher CIMT indicates more atherosclerotic burden in the body. Hence evaluation of CIMT is a reliable method of assessing atherosclerosis<sup>(4), (5)</sup>. Carotid B Mode ultrasound Imaging is an accurate, non-invasive, cost effective, easy, widely available, easily reproducible method for assessing CIMT <sup>(6)</sup>. CIMT on B Mode ultrasound of carotid arteries corresponds very well to histologic intima and media. It can roughly quantify atherosclerotic burden in the body. Increasing age is also an independent risk factor for atherosclerosis and increased CIMT <sup>(7)(8)</sup>.

CIMT is defined as the area of tissue starting at the luminal- intimal interface and media-adventitia interface of Carotid artery; or more precisely defined as the double line pattern visualized by B Mode vascular ultrasound formed by two parallel echogenic lines representing junction of the vessel lumen with the intima; and media- adventitia interface. Thickening of the intima-media complex implies occult plaque formation, but plaque is seen directly with

ultrasound when it achieves sufficient size to protrude into the carotid artery lumen. CIMT varies widely across different age groups. It increases with increasing age <sup>(7, 8)</sup>. The CIMT measurements in this study were done in areas excluding visible plaques.

### Materials and Methods :-

A descriptive study was conducted. Prospective data was collected over a period of one year from December 2014 to November 2015. All individuals reporting consecutively during this period to Radiology department of our institution, Smt Kashibai Navale Medical College and General Hospital, Pune were considered for this study. Their demographic features (age, sex), diagnosis and a documented history of cerebrovascular disease, ischaemic heart disease or the presence of vascular risk factors, history of smoking or using tobacco any form were collected. The patients were divided in two groups for analysis; Group A (Smokers group):- All the patients with smoking habits & using tobacco in all forms with or without any other risk factors of atherosclerosis like diabetes, hypertension, those with current or past history of alcohol consumption, dyslipidemia and obesity were included in smokers group. Group B (Non smokers group):- Subjects with no smoking habits or using tobacco in any forms with or without any other risk factors of atherosclerosis like diabetes, hypertension, those with current or past history of alcohol consumption, dyslipidemia and obesity were included in nonsmokers group. Subjects in the age group of 22 to 86 years were included in the study. Carotid artery ultrasonography was

performed on all these subjects. Total number of subjects included in this study was 415. Out of them 263 were males, 151 were females and one belonged to other sex. Group A had 88 subjects. Group B had 327 subjects. Institute's permission to carry out the study was taken and a consent from the subjects was obtained.

Analysis of variance (ANOVA) was used to compare continuous variables. Regression analysis was conducted to estimate the effect of smoking on carotid injury. 95% Confidence Interval was calculated wherever applicable. P value  $\leq 0.05$  was deemed significant. IBM SPSS 20 was used for statistical analysis.

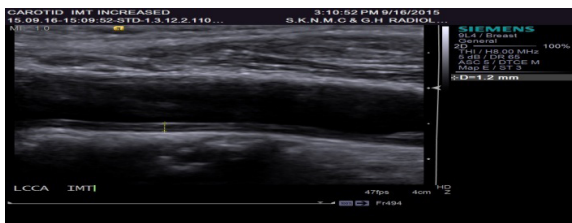
**Ultrasound Protocol:-**

All the carotid ultrasound examinations were done on Siemens Acuson X 300 and Siemens Acuson S 2000 ultrasound machines with high frequency probes of more than 7.5MHz frequency. Both ultrasound operators were the above mentioned first two investigators in this study; both Radiologists having 20 years of experience in conducting B Mode ultrasound and colour Doppler studies of carotid arteries. Interobserver and intraobserver errors were eliminated by strict adherence to examination protocol as follows.

Each patient (subject) was explained the procedure and ensured that the patient was comfortable and cooperative during the procedure. As CIMT of CCA ( common carotid artery) has better reproducibility than that of ICA( internal carotid artery) or carotid bifurcation due to ease of access and proximity to the surface and CCA being relatively parallel to skin, measurement of CIMT was done at this site on far wall of CCA in all patients. Presence or absence of atherosclerotic plaques were also noted. CIMT was measured in areas excluding the plaque. Both sonologist and patient were positioned properly to obtain high quality images. CIMT measurement was done in supine position with head of patient resting comfortably and neck slightly hyperextended and rotated in direction opposite to the probe. A wedge pillow at an angle of 45 degrees was used to standardize the lateral rotation. Images were optimized by adjusting patient's neck position and rolled towels were given under neck for comfort.

The six values of mean CIMT ( three on each side) were obtained and averaged to get mean CIMT <sup>(9)</sup>. Thus a single mean CIMT value was obtained in each subject.

**Images:-**



**B Mode Ultrasound Image showing longitudinal section of CCA**

**Results:-**

Total cases studied 415. (n=415)

**Age in years**

Mean	N	Std. Deviation	Median	Minimum	Maximum
56.7614	415	13.42679	59.0000	22.00	86.00

**Table 1:- showing age distribution in the sample**

**Frequencies:**

**Sex**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	151	36.4	36.4	36.4
	Male	263	63.4	63.4	99.8
	Other	1	.2	.2	100.0
	Total	415	100.0	100.0	

**Table 2:- showing distribution of sex in the sample.**

		N	Percent
Valid	Non- tobacco users or smokers	327	78.8
	Tobacco-users or smokers	88	21.2
	Total	415	100.0

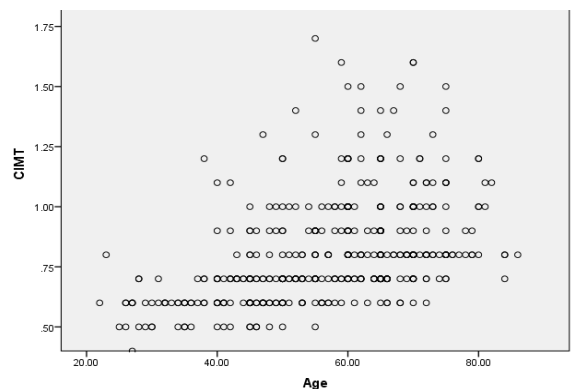
**Table 3 :- indicating frequency of smokers and non-smokers in the sample**

CIMT in mm					
Mean	N	Std. Deviation	Median	Minimum	Maximum
.8072	415	.22088	.7000	.40	1.70

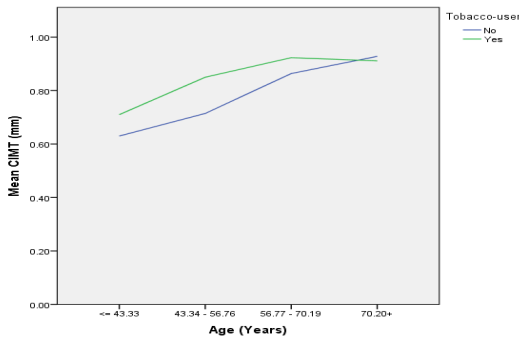
**Table 4:- showing CIMT of the entire sample irrespective of age and sex**

Age Group	Age range yrs	Mean CIMT mm	N	Std. Deviation	Median
1	<=43.33	.6414	70	.13987	.6000
2	43.34-56.76	.7483	120	.19272	.7000
3	56.77-70.19	.8777	166	.22411	.8000
4	70.20+	.9254	59	.19262	.8000
Total		.8072	415	.22088	.7000

**Table 5:- indicating CIMT in different age groups in the sample irrespective of whether they are smokers or nonsmokers**  
Classification based on Mean CIMT +/- 1SD"



**Graph 1:- showing distribution of CIMT of the entire sample**



Graph 2:- showing CIMT with its relation to age in smokers and nonsmokers

Age-group	Smoking	Mean	N	Std. Deviation	Median	P
1	.00	.6300	60	.12392	.6000	
	1.00	.7111	10	.20790	.7000	0.09
	Total	.6414	70	.13987	.6000	
2	.00	.7144	90	.16115	.7000	
	1.00	.8500	30	.24176	.8000	0.001
	Total	.7483	120	.19272	.7000	
3	.00	.8638	127	.22349	.8000	
	1.00	.9231	39	.22297	.9000	0.15
	Total	.8777	166	.22411	.8000	
4	.00	.9280	50	.19799	.8000	
	1.00	.9111	9	.16915	.9000	0.81
	Total	.9254	59	.19262	.8000	
Total	.00	.7896	327	.21539	.7000	
	1.00	.8727	88	.22981	.8000	0.002
	Total	.8072	415	.22088	.7000	

Table 6:- indicating CIMT in smokers and nonsmokers in different age groups

Smoking :- .00 means nonsmokers & not using tobacco in

any form

Smoking :- 1.00 means smokers or tobacco users

**Conclusion and discussion:-**

The data of present study of local Indian population mainly comprising of low income group in and around Pune confirms the findings of previous studies in general population. Hence it has been found in the present study that CIMT values in subjects who are smokers or use tobacco in different forms in local Indian population of low income group are significantly higher than those who were non-smokers or not using tobacco in any form in the same income group after adjusting for other risk factors for atherosclerosis like DM, HTN and for increasing age (P=0.002). Hence it appears from the present study that those individuals having history of cigarette smoking and using tobacco in all other forms have a significantly higher risk of atherosclerotic disease and hence a higher risk of cardiovascular or cerebrovascular disease. Carotid B Mode ultrasound Imaging is an accurate, non-invasive, cost effective, easy, widely available, easily reproducible method for assessing CIMT and hence can reliably assess atherosclerotic burden in smokers. So it may be worthwhile screening older adult smokers by B Mode carotid ultrasound so that a preventive therapy may be initiated in those found to have evidence of atherosclerosis to prevent risk of stroke or ischemic heart disease (6).

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