SONOGRAPHIC EVALUATION OF CAROTID ARTERY INTIMA-MEDIA THICKNESS IN DIFERENET AGE GROUPS

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Abstract

Background:

The common carotid arteries are major blood vessels that supply blood to the neck and head. They are also responsible for delivering oxygen-rich blood to neck, face and brain. Common carotid artery intima-media thickness IMT is define as measurement of thickness of two inner layers of carotid artery wall, the intima and media. Normal CCA-IMT is typically under 0.9mm.

Objective:

Was to find sonographic evaluation of common carotid artery intima media thickness in different age groups.

Methodology:

A total of 191 both male and female subjects were taken, both male and female had different age groups are included in this study. Sample size is taken from a clinic situated in Green Town Lahore. A cross sectional survey was conducted through non probability convenient sampling. Data was collected through detailed history taken from subjects, through questioner sheets and ultrasonic findings. Thickness of intima-media were found through ultrasound in different age groups. Data analysis was done by MS excel software.

Results:

191 test subjects both male and female from different age groups were selected for his study. Detailed medical history through interview were taken from all the subjects, questioner sheets were used for the data collection. Data analysis was done by MS excel software. Independent sample t-test is applied for the analysis which reveals direct association between intima-media thickness variations and age factor. Chi square is alsoapplied to the risk factor which reveals many risk factors like smoking, alcohol, cholesterol all also associated with the abnormality of the intima-media

thickness.

Conclusion:

This study shows there is strong association between increasing age, medical histories (smoking, stroke, lipedema) and abnormal thickness of intima-media specifically on left side, abnormal intima media thickness can lead to many other complications like, higher risk of stroke, PAD, and other cardiovascular events.

INTRODUCTION

Intima-media thickness (IMT) in the common carotid artery is a crucial measure of blood vessel health. It shows the thickness of the innermost and middle layers of the artery wall. A higher IMT is linked to an increased risk of cardiovascular diseases like atherosclerosis. Age-related changes in common carotid artery intima-media thickness. The quantitative assessment of atherosclerosis in populations is essential to a better understanding of the pathophysiology of the lesions and to the prediction or prevention of consequent development of atherosclerotic diseases. In recent years, ultrasonic measurement has been available for noninvasive assessment of local plaque formation and intima-media thickening in the extracranial carotid arteries. (Ando et al., 2000) Atherosclerosis plays a major role in the development of cardiovascular disease (CVD) and is characterised by thickening of the tunica media and intima of the arterial wall. Because thickening of the arterial wall occurs before clinical presentation of plaque formation, measurement of the carotid artery intima-medial thickness is a common and early surrogate marker for atherosclerosis. (Van Den Munckhof et al., 2018) Recently, an increased thickness of carotid IMT determined by B-mode ultrasound has been shown to be directly associated with an increased risk of myocardial infarction and stroke without a previous history of cardiovascular disease. Thus, carotid artery IMT has been proposed as a risk factor that may be included in the algorithms for cardiovascular risk assessment. (Baldassarre et al., 2000)

In different age groups, there are variations in common carotid artery IMT. Studies have shown that as individuals age, there is a gradual increase in IMT due to the accumulation of atherosclerotic plaques. This thickening of the intima and media

layers of the artery is associated with an increased risk of cardiovascular events such as heart attacks and strokes. (Dr. Daniel H. O'Leary 2019). Multiple studies and meta-analyses have proposed that carotid intima- media thickness (CIMT) measurement and identifying the details of the carotid plaque can be helpful for risk assessment in patients having intermediate cardiovascular disease (CVD) risk. (Jain et al., 2023)

Intima-media thickness (IMT) is a marker of subclinical atherosclerosis (asymptomatic organ damage) and should be evaluated in every asymptomatic adult or hypertensive patient at moderate risk for cardiovascular disease. Intima-media thickness values of more than 0.9 mm or over the 75th percentile should be considered abnormal. A carotid artery ultrasound scan is the method of choice, and results are reliable, provided certain standards are followed. (Simova, n.d.)

By measuring IMT, healthcare professionals can identify individuals at high risk and take preventive measures to reduce the risk of cardiovascular events. (O'Leary et al., 1999) According to (O'Leary et al., 1999), intima media thickness (IMT) in the common carotid artery increases with age.

Measurement of common carotid artery intima-media thickness (CCA-IMT) with a B-mode ultrasonography is a valid approach for identifying and quantifying the presence of subclinical disorders. It is a noninvasive, sensitive, and reproducible technique for identifying and quantifying atherosclerotic risk. It is also a well-validated research tool that has been translated into clinical practice. (Mahmoud, 2013)

The mean CAIMT of healthy subjects including ail age group was (754.94 ± 11.96 micron.). Mean CAIMT was higher in age group of 61–80 years (908.75 ± 39.02 micron) than age group of 20–40

years (713.62 ± 16.59 micron) and 41–60 years (745.55 ± 13.05 micron). CAIMT was positively correlated with age (P value < 0.001) and sex (P value = 0.001). An aggregated analysis based on this study in different age groups of healthy people may be useful for assessing carotid artery abnormalities as an aid to defining abnormalities and predicting risk of atherosclerosis in individual healthy people. (Paul et al., 2012b)

This study was designed with an aim to determine the ultrasonic common carotid arteries IMT.

Study design: Cross-sectional analytical design was used.
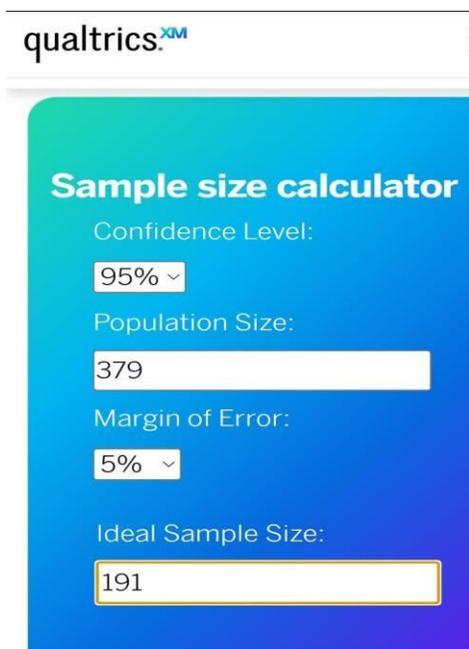
Setting:
Data was collected from UOL ultrasound Clinic Green town Lahore.

Study duration:
It was 4 months

Sample size: Sample size was calculated through Qualtrics Software. Which is 191.

MATERIALS AND METHODS:

Sample technique:

Non probability convenient sampling technique.

SAMPLE SELECTION:

Sample Selection:
Inclusion criteria:
•   Both male and female.
•   Different age groups of common carotid artery with intima media thickness were included.

Exclusion criteria:
•   Multiple pregnancies

•   Inability to Cooperate
•   Medications
•   Significant Arterial Pathologies
•   Systemic Diseases
•   Recent Cardiovascular Events

Equipment:
Ultrasound High-resolution B-mode system (B-mode imaging is preferred over M-mode imaging), equipped with a linear array transducer >7 MHz.

RESULTS:

A cross sectional analytical survey was done to do sonographic evaluation of common carotid artery intima-media thickness in different age groups. 191 subjects were taken in this study.

Table 1:
Descriptive statics of variables (N=191)

	N	Minimum	Maximum	Mean	Median	SD
Age	191	6.000	76.000	42.738	41.000	14.3106

M= Mean, SD=Standard Deviation

Describes that the mean age of is 42.738 from 191 subjects both male and female included. The standard deviation is 14.3106. The minimum age is 6.000 means the youngest patient was of 6 years. And the maximum age is 76.000 from 191 subjects.

Table 2:
(N=191)
Independent samples t-test:

Sample 1	
Variable	Age
Sample 2	
Variable	IMT_Left_CCA_mm_ IMT Left CCA (mm)

	Sample 1	Sample 2
Sample size	191	191
Arithmetic mean	42.7382	12.7277
95% CI for the mean	40.6957 to 44.7807	10.0405 to 15.4150
Variance	204.7943	354.4939
Standard deviation	14.3106	18.8280
Standard error of the mean	1.0355	1.3623

F-test for equal variances	$P < 0.001$

This table is showing Independent samples t-test evaluations between two variables which are Age and IMT measurements of left carotid artery.

P vale Significance level is <0.001. which shows direct association between age and changes in thickness of IMT.

TABLE 3:
(N=191)
Independent samples t-test:

Sample 1	
Variable	Age
Sample 2	
Variable	IMT_Right_CCA_mm_ IMT Right CCA (mm)

	Sample 1	Sample 2
Sample size	191	191
Arithmetic mean	42.7382	7.0524
95% CI for the mean	40.6957 to 44.7807	6.0046 to 8.1001
Variance	204.7943	53.8920
Standard deviation	14.3106	7.3411
Standard error of the mean	1.0355	0.5312

F- test for equal variances	$P < 0.001$

This table is showing Independent samples t-test evaluations between two variables which are Age and IMT measurements of right carotid artery.

P vale Significance level is <0.001. which shows direct association between age and changes in thickness of IMT.

TABLE 4:
Chi-Square Test:
N= (191)

Classification X	Medical_History Medical History	
Acute Neck Pain	1	0.5%
Arthritis	5	2.6%
Atherosclerosis	4	2.1%
Body Inflammation	1	0.5%
Brain Stroke	1	0.5%
Cancer	1	0.5%
Cardiomayopathy	1	0.5%
Cardiovascular Disease	2	1.0%

Cervical Myelopathy	1	0.5%
CKD	10	5.2%
Coronary Artery Disease	24	12.6%
CVD	11	5.8%
Depressive Symptoms	2	1.0%
Diabetes	20	10.5%
Diabetes II	5	2.6%
Genetical history	3	1.6%
Glycaemia	2	1.0%

|		
HDL	1	0.5%
Headache	1	0.5%
High Cholestrol	6	3.1%
Hyperlipidemia	15	7.9%
Hyperplasia Liver	1	0.5%
Hypertension	35	18.3%
Hyperthyrodism	1	0.5%
Inflammation	1	0.5%
Migraine	3	1.6%
None	4	2.1%
Pain in lateral Neck region	1	0.5%
Perfusion Weakness	1	0.5%
Smoker	2	1.0%
Smoking	11	5.8%
Stroke	4	2.1%
Substance use disorder	2	1.0%
Vascular disease	8	4.2%
Total	191	100.0%

Chi-squared test

Chi-squared	346.058
DF	33
Significance level	P < 0.0001

Chi square test is applied to the medical histories of all the 191 subjects, according to this table out of 191 subjects, 0.5% had acute neck pain, 2.6% had arthritis, 2.1% had atherosclerosis, 0.5% hadbody inflammation, 0.5% had brain stroke, 0.5% had cancer, 0.5% had cardiac myopathy, 1.0% had CVD, 0.5% had cardiac myelopathy, 5.2% had CKD, 12.6% had CAD, 5.8% had CVD, 1.0%

had depressive symptoms, 10.5% had diabetes type 1, 2.6% had diabetes type 2, 1.6% had genetic

history, 1.0% had glycaemia, 0.5% had HDL, 0.5% had headache, 3.1% had high cholesterol, 7.9% had hyperlipidemia, 0.5% had hyperplasia liver, 18.3% had hypertension, 0.5% had hyperthyroidism, 0.5% had inflammation, 1.6% had migraine, 2.1% had none, 0.5% had pain in lateral neck region, 0.5% had perfusion weakness, 1.0% had smoking history, 5.8% were chain smokers, 2.1% had stroke, 1.0% had substance use disorder, 4.2% had vascular diseases. P value significance level is <0.0001.
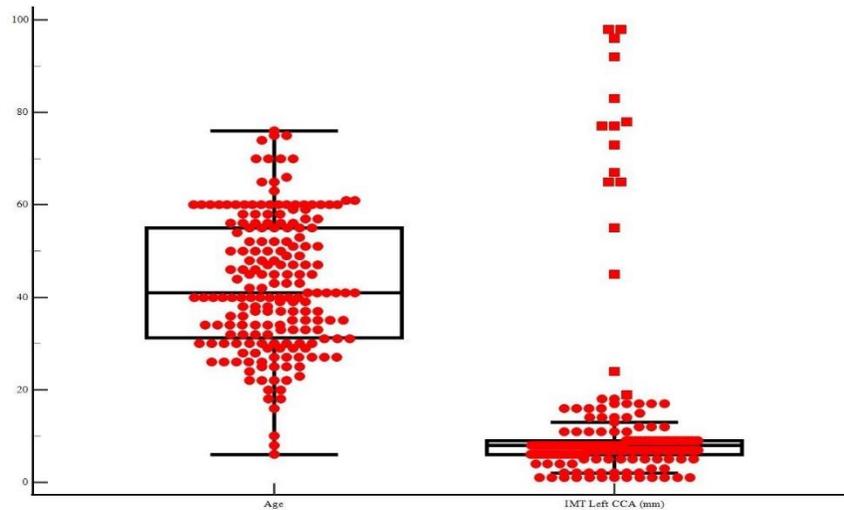
FIGURE 1:
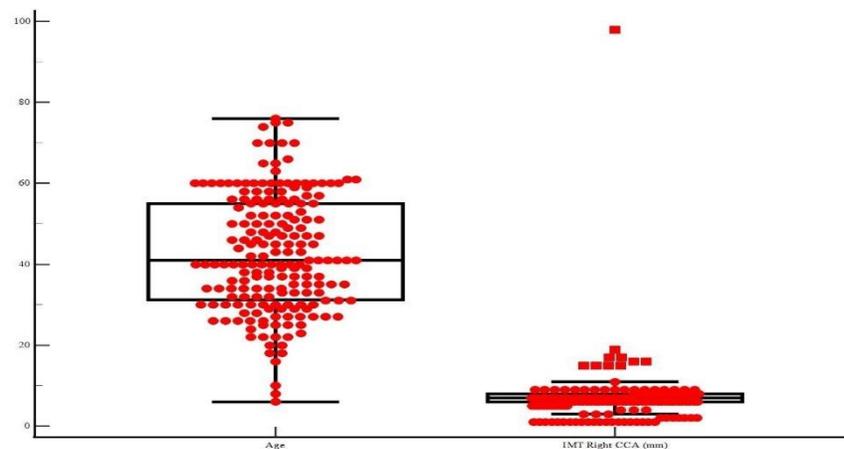
Presence of Plaque (N=191)
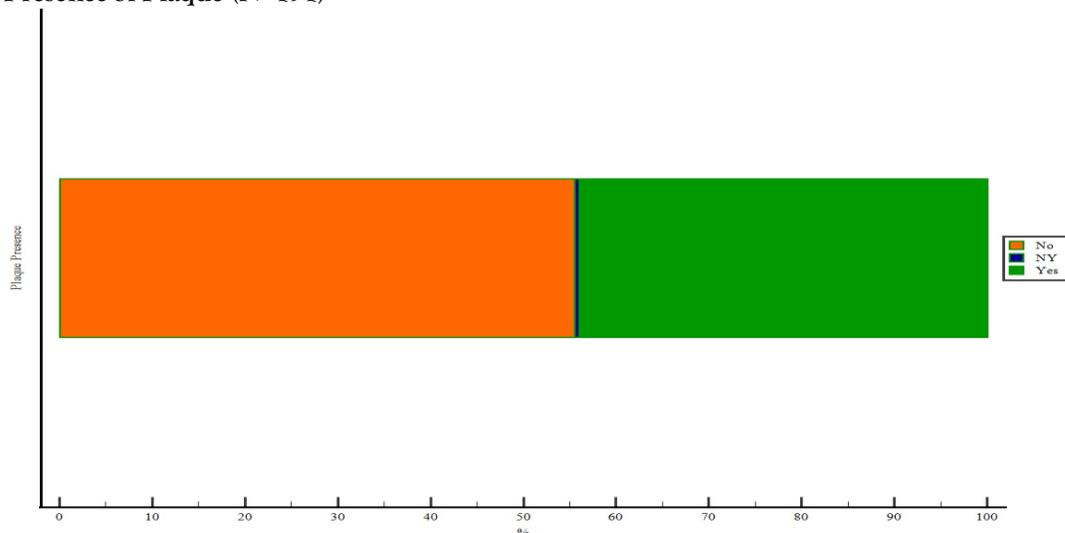
This figure shows in how many of test subjects plaque is found. According to this figure 55% test subject showed plaque during their examination.

FIGURE 2:
Box Plot:
(N=191)

In this graph Wishker dot and box plot showing mean difference between age and Left intima media thickness.

FIGURE 3:
Box Plot:
(N=191)

In this graph Wishker dot and box plot showing mean difference between age and Right intima media thickness.

DISCUSSION:

A cross sectional analytical survey was done to find out the sonographic evaluation of common carotid artery intima media thickness in different age group. 191 subjects of different age groups

both males and female were taken in this study. Carotid artery are large blood vessels that carry blood from the heart to head, neck and brain. There are two carotid arteries on each side left carotid artery and right carotid artery. Its function is very essential in regulating blood pressure and heart rate. In this study both males and female od different age groups were included and the man purpose of this research was to find out the sonographic evaluation of carotid artery intima-media thickness of both sides. Carotid artery intima media thickness measurement is very important because it serves as non-invasive way to detect the early sign of atherosclerosis. Which can be helpful to prevent many other medical complications. We took detailed interview from the subject in which we asked about their medical histories through open ended questions. We also collected data through questionnaire sheets. After that we use simple and Doppler ultrasound for radiological findings of CIMT. We used linear probe with 7MHz frequency for the scan.

We did detailed scan and our main goal was to assess differences of intima-media thickness of carotid artery. This measurement helps assess the presence and extent of early plaque buildup, which is an indicator of cardiovascular diseases risk. Normal CIMT values generally ranges from 0.6-0.7 mm, but values of 1mm and more are linked with increased CVD risks.

CIMT measurement are typically obtained using ultrasound imaging, which creates longitudinal images of carotid artery. The double line pattern on the images, representing the intima and media layers, is used to measure the CIMT. The measurement focuses on the leading edges of these layers, not the actual plaque itself. CIMT abnormality is the serious problem leading to many other complications like stroke and myocardial infarction. Many of the subjects didn't even knew about the plaque and arthrosclerosis and this problem is need to be addressed. Primary precautions and knowledge about can decrease the prevalence of complications. Providing counselling is also very important to reduce the morbidity rate, and other associated health problems.

To this I, am sure that no study has been conducted to find the evaluation of carotid artery intima- media thickness in different age groups. This study found that strong association of CIMT abnormalities with increasing age and other risk factors like HDL, smoking is found. This is a cross-sectional study which include 191 individuals.

CONCLUSIONS:

Direct and strong association between carotid artery intima media thickness abnormality with increasing age and other risk factors like HDL, smoking is found. Left side carotid artery intima-media thickness is more affected than right carotid artery intima-media thickness. About 55% of test subjects are found with plaque. Out of 191 subjects only 2.1% test subjects didn't show any medical history or risk factor. Abnormal intima media thickness can lead to many other complications like, higher risk of stroke, PAD, and other cardiovascular events.

LIMITATIONS:

- In current review there was no variable related to specific age groups, in forthcoming review specific age groups can be add because aging can be associated.
- The study can also be done on children to assess their carotid artery.
- Even though research was conducted on participants of Lahore, in a narrow time there is need to spread this to further capitals of the state.

RECOMMENDATIONS:

- This survey was first ethnic research of finding the sonographic features of intima-media thickness.
- This study piece has a strength to plug this study gap and aware the people with their health problems related to many medical conditions like PVD and Cardiovascular diseases.

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