ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A correlative study on the association of Brachial Arterial Intima Media Thickness (BA IMT) and Coronary Artery Disease (CAD) so as to quantify BA IMT as a biomarker of atherosclerosis

Gaurav Balpande[1#], * Sobana R[2#], Smirta Swamy[3#], Madanmohan[4#], Amirtha Ganesh[5#], Parthasarahy[6#], Jaiganesh K[7#]

[1]Final year Postgraduate, Department of Radiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.
[2]Associate Professor, Department of Physiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.
[3]Professor of Radiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.
[4]Professor of Physiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.
[5]Professor of Cardiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.
[6]Associate Professor of Anaesthesiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.
[7]Professor of Physiology, Mahatma Gandhi Medical College & Research Institute, Sri Balaji Vidyapeeth University,Pondicherry. 607 403.

ABSTRACT

Carotid Intima Media Thickness is a marker of atherosclerosis and predictive risk factor of Coronary Artery Disease (CAD). As carotid IMT estimation warranties high degree of expertise we searched for alternate sites IMT estimation. So the study was conducted to estimate and compare the BA IMT of patients diagnosed to have CAD (Group I) with age, gender matched healthy control (Group II) and its correlation with the Framingham's risk scores. Grey scale USG examination performed using MINDRAY DC-8 ultrasound equipment with linear phased array transducer probe of frequency 12 MHz .In the midpoint between medial aspect of elbow and shoulder IMT measurements done in longitudinal segment, extending from the intima- luminal interface up to the inner hyper echoic margin of the adventitia (media-adventitia interface).The average of three values recorded. The mean BA IMT of group I is 0.603 ± 0.1351, group II is 0.453 ± 0.0629 with statistical significant (p=0.0001) by independent t test. Systolic BP is more strongly correlated (Pearson's correlation r=0.603, p=0.03) and diastolic weakly correlated (Pearson's correlation r=0.122, p =0.05) with mean IMT.Amongst the various lipid profile, HDL shows negative correlation with the mean IMT (Pearson's correlation r = -0.611, p=0.02) whereas LDL is positively correlated (r= 0.501, p=0.05).Since BA IMT is significantly elevated in patients CAD and correlates positively with Framingham's risk scores we can conclude that it is marker of atherosclerosis hence can be used as a predictive risk factor of CAD.

Keywords: Atherosclerosis, Brachial artery intima media thickness, CAD, Biomarker.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Atherosclerosis is a major predisposing cause of Coronary Artery Disease [1]. The markers of atherosclerosis are included in the Framingham's risk scores which predict the risk of CAD [2]. Detecting atherosclerosis early is of great clinical importance in preventing the occurrence of CAD. Lifestyle modifications, dietary alterations, health awareness counselling and pharmacological interventions can influence the progression of atherosclerosis and prevent its complications [3, 4]. Journal of American College of Cardiology recommend the estimation of IMT of peripheral vessels especially carotid as a validated non-invasive marker of atherosclerosis, hence as a risk factor of CAD [5]. The search of alternate sites for IMT estimation is being in vogue, such as popliteal, brachial as carotid IMT estimation warranties high degree of expertise [6]. Our study aims in the comparison of mean brachial arterial IMT of subjects diagnosed to have CAD and healthy controls in south Indian population and its association withbiochemical, hemodynamic variables which are major cardiovascular risk factors.

AIM & OBJECTIVES:

- To estimation and compare the BA IMT of patients diagnosed to have CAD and the age, gender matched healthy control.
- To analyse the correlation ofage, gender, lipid profile, arterial Blood Pressure with the BA IMT in both groups.

METHODOLOGY

Study design: Analytical case control study.

INCLUSION CRITERIA:

- Group I: 60 subjects of aged 35 to 70 years diagnosed as CAD. Based on the coronary angiogram report suggestive of > or = 30% diameter stenosis of at least > or =1 major branch of coronary artery [7].
- Group II: Age and gender matched healthy subjects.

EXCLUSION CRITERIA: Peripheral Arterial Disease.

The study was conducted after obtaining clearance from the Institutional Human Ethical Committee (IHEC). Patients attending the cardiology department diagnosed to have CAD are recruited after obtaining written informed consent. Healthy age, gender matched controls are randomly selected from the patients undergoing routine Master health checkup.Anthropometric, biochemical data and vitals are extracted from their clinical records.

GREY SCALE USG EXAMINATION:

USG examination was carried out in the Department of Radiology, using MINDRAY DC-8 ultrasound equipment with linear phased array transducer probe at a frequency of 12 Mhz. Patient was instructed to lie supine on the examination table, with right arm in neutral position and slightly abducted away from the body.

Point was marked at the midpoint of the arm between the elbow and the shoulder on the medial aspect, cuppling gel was applied. The transducer was moved in both transverse and longitudinal direction in order to obtain clear images of the brachial artery, and TGC (Time Gain Compensation) was adjusted to ensure that the far wall of the artery is optimally visualized. The measurement of the IMT was performed on a longitudinal segment of the brachial artery, extending from the intima- luminal interface up to the inner hyper echoic margin of the adventitia (media- adventitia interface). Three values were taken and the average values were recorded. The clinical data was correlated with the Ultrasonography findings and the resultant data was subjected to relevant statistical evaluation.

ISSN: 0975-8585

STATISTICS:

- Independent t test (compare mean IMT of both the groups)
- Correlation between BA IMT with, age, sex, BP, lipid profile (HDL, LDL levels), cardiovascular status is assessed by multipleregressions.

RESULTS

Analysis of the data gives the following results.

MEAN BA IMT IN CASE AND CONTROL:

Table.1 shows the mean IMT of group I is 0.603 ± 0.1351 and of group II is 0.453 ± 0.0629 which is statistically significant (p=0.0001) by independent t test.

Table.1: BA IMT in case & control

N	Mean ± std deviation	t	df	Sig (2 tailed)
Group I - IMT Group II - IMT	0.603 ± 0.1351 0.453 ± 0.0629	5.512	40.994	0.0001

Group I: Subjects diagnosed to have CAD, Group II: Age, gender matched control.
BA IMT: Brachial artery intima media thickness in mm.

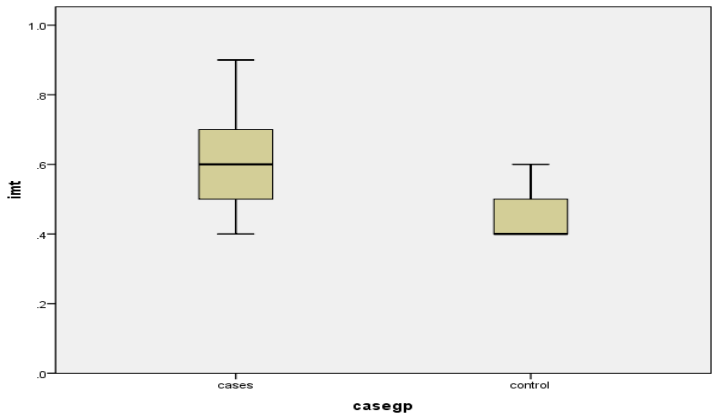

Figure.1: BA IMT in case & control

CORRELATION OF AGE AND BA IMT:

Table.2 Shows positive correlation (Pearson's correlation r=0.817) of age (mean 49 years) with Mean BA IMT of both groups 0.428±0.1290 with statistical significance (p=0.0001).

Table.2: Age vs. BA IMT

		IMT	Age
IMT	Pearson Correlation	1	.817**
	Sig. (2-tailed)		.000
	N	60	60
Age	Pearson Correlation	.817**	1
	Sig. (2-tailed)	.000	
	N	60	60

Age in years, **. Correlation is significant at the 0.01 level (2-tailed).

ISSN: 0975-8585

CORRELATION OF PREDICTOR VARIABLES AND BA IMT:

Table.3 depicts the correlation between BA IMT and predictor variables. Systolic BP is more strongly correlated (Pearson's correlation r=0.603, p=0.03) and diastolic weakly correlated (Pearson's correlation r=0.122, p =0.05) with mean IMT. Amongst the various lipid profile, HDL shows negative correlation with the mean IMT (Pearson's correlation r= - 0.611, p=0.02) whereas LDL is positively correlated (r= 0.501, p= 0.05)

Table.3: BA IMT vs. Predictor variables

Variables	r	p value
Age	**+ 0.817**	**0.0001**
Systolic Blood Pressure	**+0.603**	**0.03**
Diastolic Blood Pressure	**+0.122**	**0.01**
HDL	**- 0.611**	**0.02**
LDL	**+0.501**	**0.05**

BA IMT: Brachial Artery Intima Media Thickness, HDL: High density lipoprotein (mg/dl), LDL: Low density lipoprotein (mg/dl).

CORRELATION OF SEX AND BA IMT:

Table.4 shows that there is no impact of sex in the IMT as men have mean thickness O.552± 0.1228 and women have 0.500 ± 0.1330.

Table.4: Intima media thickness(IMT) Vs. sex

		N	Mean ± std deviation		t	df	sig(2 tailed)
IMT	Men	63	0.552	0.1228	1.545	53.688	0.125
	Women	57	0.500	0.1330			

DISCUSSION

Our results show a mean IMT of 0.428 ± 0.1290 slightly higher than the earlier studies by Mathias Fricks et al who recorded 0.37±0.07 vs. 0.31±0.07 mm as normal IMT and measurements >0.44 mm as raised thickness . The dietary habits of high carbohydrate and sedentary lifestyle of the South Indian population can be attributed to this mean high IMT of the Asian population compared to Western [8].

Age shows a positive correlation with mean IMT and is in concordance with previous research findings by Frick M in the study of prognostic value of brachial artery endothelial function and thickness [9].

Elevated carotid IMT in patients with CADwas observed in earlier studies by Corrodo Maratari, Luo G and Faulx made the carotid IMT as a surrogate marker of atherosclerosis and is documented in the American Heart Journal [10, 11, and 12]. We could observe mean brachial IMT of CAD patients to be 0.603 ± 0.1351whereas the control have 0.453 ± 0.0629 which is statistically significant (p=0.0001). So brachial IMT can also be considered as a non-invasive marker of atherosclerosis.

Yumiko Iwamoto and co-workers, documents the relationship of multiple cardiovascular riskfactors (Framingham's risk scores) with both carotid and brachial IMT and concludes brachial IMT too can be a marker of atherosclerosis. Blood pressure is one of this risk factor. The positive correlation of systolic BP (r=0.603, p=0.03) in our result supports us to quantify the BA IMT as a predictor of CV risk [13].

Lars Linda's population based cohort study Prospective Investigation of Vasculature in Uppsala Seniors (PIVUS) done on BAIMT and Framingham's risk scores documented traditional lipid variables especially HDL, markers of stress were associated with thickness of BA intima media complex hence can be used as biomarker of atherosclerosis.The association of lipid profile especially HDL with IMT (r= -0.611, p=0.02) in our study coincides with the PIVUS findings [14]

There is no difference (p=0.125) in the mean IMT between men (0.552 ± 0.1228) and women (0.500 ±0.1330)in our study, but Jennek et al observes morphology and dispensability of arteries depend on gender with women having higher IMT than Men [15]. The difference in genetic setup, lifestyle could be the reason for this finding.

CONCLUSION

The elevated BA IMT of CAD patients compared to healthy control and the positive correlation with the Framingham's cardiovascular risk scores namely systolic BP and lipid profile, we can utilise estimation of BA IMT as a non-invasive marker of atherosclerosis in asymptomatic subjects. Hence early prediction and preventive interventions can be adopted before progression of cardiovascular complications.

The finding has to be further explored withassessment of association of other risks scores and with different age group of subjects.

REFERENCES

[1] Cerne, A., & Kranjec, I. (2002). Atherosclerotic burden in coronary and peripheral arteries in patients with first clinical manifestation of coronary artery disease. *Heart and Vessels, 16*(6), 217-26. doi:http://dx.doi.org/10.1007/s003800200028

[2] Lau, K., Chan, Y., Yiu, K., Tam, S., Li, S., Lau, C., & Tse, H. (2008). Incremental predictive value of vascular assessments combined with the Framingham risk score for prediction of coronary events in subjects of low-intermediate risk. *Postgraduate Medical Journal, 84*(989), 153. doi:http://dx.doi.org/10.1136/pgmj.2007.064089

[3] Natale, F., Ranieri, A., Siciliano, A., Casillo, B., Di Lorenzo, C., Granato, C., Calabrò, R. (2014). Rapid ultrasound score as an indicator of atherosclerosis' clinical manifestations in a population of hypertensives: The interrelationship between flow-mediated dilatation of brachial artery, carotid intima thickness, renal resistive index and retina resistive index of central artery. *Anadulu Kardiyoloji Dergisi : AKD, 14*(1), 9-15. Retrieved from http://search.proquest.com/docview/1648066326?accountid=164174

[4] Simova, I., & Denchev, S. (2008). Endothelial functional and structural impairment in patients with different degrees of coronary artery disease development. *Heart and Vessels, 23*(5), 308-15. doi:http://dx.doi.org/10.1007/s00380-008-1054-9

[5] Fathi, R., Haluska, B., Isbel, N., Short, L., & Marwick, T. H. (2004). The relative importance of vascular structure and function in predicting cardiovascular events. *Journal of the American College of Cardiology, 43*(4), 616-23. doi:http://dx.doi.org/10.1016/j.jacc.2003.09.042

[6] Lacroix, P., Aboyans, V., Espaliat, E., Cornu, E., & al, e. (2003). Carotid intima-media thickness as predictor of secondary events after coronary angioplasty. *International Angiology, 22*(3), 279-83. Retrieved from http://search.proquest.com/docview/229789468?accountid=164174

[7] Coronary artery disease; B-mode ultrasonography in the brachial artery may be useful in CAD evaluation. (2005). *Cardiovascular Week,* 93. Retrieved from http://search.proquest.com/docview/235053855?accountid=164174

[8] Frick, M., Schwarzacher, S. P., Alber, H. F., Rinner, A., Ulmer, H., Pachinger, O., &Weidinger, F. (2002). Morphologic rather than functional or mechanical sonographic parameters of the brachial artery are related to angiographically evident coronary atherosclerosis. *Journal of the American College of Cardiology, 40*(10), 1825-1830. doi:http://dx.doi.org/10.1016/S0735-1097(02)02480-4

[9] Coronary artery disease; B-mode ultrasonography in the brachial artery may be useful in CAD evaluation. (2005). *Science Letter,* 470. Retrieved from http://search.proquest.com/docview/209216089?accountid=164174

[10] Corrado, E., Muratori, I., Tantillo, R., Contorno, F., & al, e. (2005). Relationship between endothelial dysfunction, intima media thickness and cardiovascular risk factors in asymptomatic subjects. *International Angiology, 24*(1), 52-8. Retrieved from http://search.proquest.com/docview/229798471?accountid=164174

[11] Luo, G., Zhang, M., Jia, X., Zheng, L., Li, Y., Zhao, H., Du, X. (2014). Correlation between brachial-ankle pulse wave velocity, carotid artery intima-media thickness, ankle-brachial index, and the severity of coronary lesions. *Cell Biochemistry and Biophysics, 70*(2), 1205-11. doi:http://dx.doi.org/10.1007/s12013-014-0043

[12] Faulx, M. D., Wright, A. T., & Hoit, B. D. (2003). Detection of endothelial dysfunction with brachial artery ultrasound scanning. *The American Heart Journal, 145*(6), 943-951. doi:http://dx.doi.org/10.1016/S0002-8703(03)00097-8

[13] Yumiko Iwamoto, Tatsuya Marukasi, Yuchi Fuchi, NaommiIdie ,Naritaka Fujimura, Intima thickness of Brachial Artery , Vascular Functions and Cardiovascular risk factors. *Atherosclerosis, Thrombosis, Vascular Biology* ,(2012)32;,2295_2303

[14] Lars Linnda, Jessika Anderson, Monika Ronn, Brachial Artery Intima Media Thickness & echogenicity in relation to lipids and markers of oxidative stress in Elderly subjects, The Prospective Investigation of Vasculature in Uppasala Seniors (PIVUS) .*Lipids* (2008)43:133-141

[15] Jannaeke JVander, Heijden Spek, Jan A, Robert H, Effect of age in Brachial Artery Wall Property differ from Aorta and is gender dependent .A population study.*HyperTension*2006;35:637- 642.