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Original Research Article

Correlation of C-F PWV and CIMT with age & gender in the healthy population of western Rajasthan

Khemlata Tilwani[1], Priya Jangid [2], Mukesh Nagal[3], Remash Kumar Tilwani[4], Madhurima Maheshwari[5]
[1,2]Assistant Professor, Dr. S.N. Medical College, Jodhpur, Rajasthan, India
[3]Consultant Physician, Medipulse Hospital, Jodhpur, Rajasthan, India
[4]Senior Specialist, Medicine, ESI Dispensary No.1 Pali, Rajasthan, India
[5]Medical Officer, Dr S.N. Medical College, Jodhpur, Rajasthan, India

***Corresponding author**
Priya Jangid
Email: dr.priyajangid@gmail.com

Abstract: The objective is to find correlation of C-F PWV and CIMT with age & gender in the healthy population. Study comprised of 100 healthy subjects from society nearby *Dr S. N. Medical College, Jodhpur.* Both C-F PWV and CIMT increased with advancing age & both were found higher in males than females and was statistically significant. Increase in carotid-femoral pulse wave velocity (C-F PWV) and carotid intima-media thickness (CIMT) indicate the risk of atherosclerosis with increasing age and in male gender.
Keywords: Carotid-femoral pulse wave velocity (C-F PWV), carotid intima-media thickness (CIMT), atherosclerosis

INTRODUCTION

Atherosclerosis is a multi-stage process that progresses through a series of structural and functional changes taking place in vessel wall culminating into manifest cerebrovascular disease. New non-invasive tools have emerged that can detect atherosclerosis in its sub-clinical phase. Carotid intima-media thickness (CIMT) and arterial pulse wave velocity (PWV) are two such promising tools. While CIMT is a marker of structural aspect of atherosclerosis, PWV reflects its functional consequences.

Intima-media thickness (IMT), is a measurement of the thickness of artery walls, usually by external ultrasound, occasionally by internal, to track the progression of atherosclerotic disease in humans.

Pulse wave velocity (PWV) is a simple measure of the time taken by the pressure wave to travel over a specific distance. PWV is now widely accepted as the 'gold standard' measure of arterial stiffness [40].

Ludwig M *et al.;* [1] studied Arterial stiffness assessed by PWV positively correlated with carotid media thickness, a marker of atherosclerotic burden in the cerebral arteries. Yokokawa, H *et al.;* [2] studied the associations between cerebral infarction and demographic factors, medical history and other clinical measurements including pulse wave velocity, a newly introduced non-invasive measurement procedure used to assess aortic stiffness.

Kobayashi K *et al.;* [3] shown that Flow-mediated dilation (FMD) of the brachial artery, carotid intima-media thickness (IMT) and pulse wave velocity (PWV) were good surrogate markers of clinical atherosclerosis. Michiel L. Bots, *et al.;* [4] found that Stroke risk increased gradually with increasing IMT. Oren, A *et al.;* [5] in Netherlands reported that carotid intima-media thickness (CIMT) and arterial stiffness are strong predictors of subsequent cerebrovascular disease (CVD) morbidity and mortality, and are well related to an unfavourable cerebrovascular risk profile. Aortic stiffness was assessed using pulse wave velocity (PWV) and CIMT was used as measure of sub-clinical atherosclerosis.

MATERIAL AND METHOD

Present study was conducted in the Department of Physiology, Dr. S.N. Medical College, Jodhpur. Participants after understanding the study

protocol and procedure were asked to give their written consents for the study.

INCLUSION CRITERIA:-
1.Healthy individuals with no atherosclerotic risk factors like high BP, diabetes, smoking etc.
2.Men and women of age greater than or equal to 40 years.

NUMBER OF CASES STUDIED:- 100.

DATA EVALUATION: This is an observational cohort study and the data was analyzed using student's t test.

EVALUATION ON A PREFORMED PROFORMA HISTORY:

Complete clinical examination, routine biochemical analysis, and Pulse wave velocity and Intima-media thicknessare measured.

METHOD*:*

Pulse wave velocity was determined by Periscope (M/S Genesis Medical Systems, Hyderabad, India) in an 8-channel real-time PC-based simultaneous acquisition and analysis system. It has dedicated hardware module connected to 4 ECG electrodes and 4 blood pressure measuring cuffs. The report contains 8-second traces of Lead I and II ECG, all pressure pulse waveforms and all calculated results. PWV was determined by a non-invasive pulse wave analyzing device. Participants were asked to refrain from drinking caffeine-containing beverages 12 h before the test. Procedure was performed in the morning hours between 8 and 10 a.m. with subject resting in supine position at least for 10 min before the recording. Electrodes for electrocardiogram were placed on ventral surface of both wrists and medial side of ankles, and BP cuffs are wrapped on both upper arm brachial artery and tibial artery above ankles. The cuffs were connected to a plethysmographic sensor, which determines volume pulse form and an oscillometric pressure sensor, which measures blood pressure volume waveforms from the brachial and tibial arteries. All the pressure recordings were done for about 10s and data was stored in the computer for analysis. Software was applied to calculate the following parameters from the waveforms, which was stored in the computer for analysis. CIMT was measured from outside the body, in larger arteries relatively close to the skin by ultrasound.

OBSERVATION

Table-1: Distribution of C-F PWV and CIMT according to age group

AGE-GROUP	TOTAL	**Av C-F PWV**	**Av CIMT**
40-49	14	509.6 ± 554.8	0.6 ± 0.14
50-59	38	1050.1 ± 146.6	0.76 ± 0.22
60-69	30	1158.9 ± 352.4	0.79 ± 0.22
70-79	18	1336.1 ± 271.5	0.86 ± 0.22
TOTAL	100	1058.9 ± 391.7	0.76 ± 0.22

Table-1 shows average C-F PWV and average CIMT according to age. As age increase, there was increase in C-F PWV that was statistically significant (p=<.0.001) & increase in CIMT that was also statistically significant (p=<.0.001).

Table-2: Distribution of C-F PWV and CIMT according to sex

Male	**Female**	**Av C-F PWV Male**	**Av C-F PWV Female**	**Av CIMT Male**	**Av CIMT Female**
8	6	609.6 ± 67.6	578.5 ± 50.2	0.64 ± 0.03	0.55 ± 0.06
24	14	1145.2 ± 78.4	986.4 ± 69.3	0.79 ± 0.06	0.62 ± 0.05
22	8	1164.9 ± 89.7	1117.0 ± 76.4	0.82 ± 0.08	0.71 ± 0.03
10	8	1345.5 ± 106.3	1276.5 ± 86.1	0.87 ± 0.04	0.84 ± 0.02
64	36	1066.3 ± 85.5	989.6 ± 70.5	0.78 ± 0.21	0.68 ± 0.16

Table-3 shows average C-F PWV and average CIMT according to sex. Both C-F PWV and CIMT were higher in males as compared to females. It was statistically significant (p<.0.001).

DISCUSSION

Aging of the common carotid artery (CCA) is associated with different principal structural, functional, and hemodynamic changes, which are often influenced by several atherosclerotic risk factors, so that it is

difficult to estimate the exclusive effect of aging on this process. In present study, both C-F PWV and CIMT increased with age. Age related arterial changes are responsible for increase in PWV and CIMT. This is supported by study of Danxia Zheng [6] *et al.;* who assessed Arterial stiffness by carotid-femoral pulse wave velocity and divided Patients into a high PWV group and a low PWV group based on the median of PWV. Age was significantly higher in the high PWV group than in the low PWV group. In the correlation analysis, PWV was positively associated with age ($p < 0.01$). Multiple regression analysis showed that PWV was independently related to Pulse Pressure ($p< 0.01$). Arno *et al.;* assess the age-related multiparametric changes of the CCA properties with ultrasound in 69 male subjects between the ages of 16 and 75 (42.4±16.5 years), who were screened for the absence of major atherosclerotic risk factors or existing vascular disease.As a result, the intima media thickness (0.052 mm/10 y) and diastolic diameter (0.17 mm/10 y) increased nearly linearly with age (r=0.60, p<0.001;and r=0.46, p<0.001, respectively). The absolute diastolic/systolic diameter change diminished by 0.10 mm/10 y (r=-0.73, p<0.001) and peak expansion velocity dropped by 0.12 cm/s per 10 years (r=-0.62,p<0.001) highly significantly with age.

In present study both C-F PWV and CIMT were found higher in males than females. Rajzer, Marek W *et al.;* [7] also had similar observation in their study where they found that the PWV was significantly higher in males than females (10.62 ± 2.2 versus 7.86 ± 1.13, $p< 0.0001$) and there was a significant positive correlation between male gender and PWV. Gen-Min Lin *et al.;* [8] In the multivariable linear regression model, traditional CVD risk factors including age, hypertension, fasting blood glucose, and low-density lipoprotein (LDL)/high-density lipoprotein (HDL) cholesterol ratio, were correlated with CIMT in the overall cohort. As compared with females, the mean CIMT was greater in males and per 1.0 standard deviation (SD) increases of body mass index and LDL/HDL cholesterol ratio in males resulted in 0.0971 (p=0.030) and 0.1177 (p=0.0087) SD increase in CIMT, respectively. These findings suggested that the impact of metabolic abnormalities on CIMT might be less in females than males.

Alejandro Díaz *et al.;* [9] PWV was measured in healthy asymptomatic and normotensive subjects without history of hypertension in first-degree relatives. PWV increases linearly with aging with a high degree of correlation with low dispersion in younger subjects. PWV progressively increases 6–8% with each decade of life; this tendency is more pronounced after 50 years. A significant increase of PWV over 50 years was demonstrated. Bin Liu *et al.;* [10] Association between CIMT and relevant risk factors in a low-income population with a high incidence of stroke in China. In this study, we evaluated mean CIMT and relevant risk factors among participants aged 45 years and over. There was a disparity between lower mean CIMT and higher incidence of stroke in this population. Established risk factors, including age, sex, education level, hypertension, smoking, SBP, DBP, FBG, and LDL-C, were significantly associated with mean CIMT; however, we observed a negative correlation between mean CIMT and TG. These findings suggest that there are distinct differences in mean CIMT and relevant risk factors between Chinese and Western populations, especially among those with a low socio-economic status.

SUMMARY AND CONCLUSION

Both C-F PWV and CIMT increased with advancing age & both C-F PWV and CIMT were found higher in males than females.

REFERENCES

1. Ludwig M, von Petzinger-Kruthoff A, Von Buquoy M, Stumpe KO. Intima media thickness of the carotid arteries: early pointer to arteriosclerosis and therapeutic endpoint. Ultraschall in der Medizin (Stuttgart, Germany: 1980). 2003 Jun; 24(3):162-74.
2. Yokokawa, H.; Goto, A.; Watanabe, K.; Yasumura, S.Department of Public Health, Fukushima Medical University School of Medicine, The Third Department of Internal Medicine, Fukushima, Japan
3. Mahomed FA. The physiology and clinical use of the sphygmograph. Med Times Gazette. 1872;1:62-4.
4. Bots ML, Launer LJ, Lindemans J, Hoes AW, Hofman A, Witteman JC, Koudstaal PJ, Grobbee DE. Homocysteine and short-term risk of myocardial infarction and stroke in the elderly: the Rotterdam Study. Archives of internal medicine. 1999 Jan 11;159(1):38-44.
5. Oren A, Vos LE, Uiterwaal CS, Grobbee DE, Bots ML. Aortic stiffness and carotid intima-media thickness: two independent markers of subclinical vascular damage in young adults?. European journal of clinical investigation. 2003 Nov 1;33(11):949-54.
6. Zheng D, Cheng LT, Zhuang ZH, Gu Y, Tang LJ, Wang T. Correlation between pulse wave velocity

and fluid distribution in hemodialysis patients. Blood purification. 2009 Feb 4;27(3):248-52.
7. Rajzer MW, Klocek M, Kawecka-Jaszcz K, Czarnecka D, Baran W, Dudek K, Petriczek T. Aortic pulse wave velocity in young normotensives with a family history of hypertension. Journal of hypertension. 1999 Dec 1; 17(12):1821-4.
8. Lin GM, Yano Y, Hoshide S. Sex Differences in the Association between Traditional Vascular Risk Factors and Subclinical Carotid Atherosclerosis in Taiwan. Journal of Atherosclerosis and Thrombosis. 2017 Jan 26:ED068.
9. Díaz A, Galli C, Tringler M, Ramírez A, Cabrera Fischer EI. Reference values of pulse wave velocity in healthy people from an urban and rural Argentinean population. International journal of hypertension. 2014 Aug 24; 2014.
10. Liu B, Ni J, Shi M, Bai L, Zhan C, Lu H, Wu Y, Tu J, Ning X, Hao J, Wang J. Carotid Intima-media Thickness and its Association with Conventional Risk Factors in Low-income Adults: A Population-based Cross-Sectional Study in China. Scientific Reports. 2017; 7.