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Gender Differences on the Effect of Non-HDL-C on Blood Pressure, Blood Flow Velocities and Arterial Wall Thickness; an Observational Analysis in Madurai Population.

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ABSTRACT

Background: Non-high density lipoprotein cholesterol has been shown to be a predictor of initial coronary heart disease events and arthrogenic. Women from Madurai have been shown to develop dyslipedemias from an early agerequiring surgical intervention when compared to women from other regions of India. This observational study was undertaken to find if the women had a higher risk for CHD when compared to men from the same region. **Methods:** 50 subjects (n=50) were inducted into this study with 26 (52%) of them were males and 24 (48%) of them were females.Patients with significant past history of major illness were excluded, including dyslipidemias, Diabetes mellitus, hypertension, myeloproliferative disorders, cardiac diseases and alcohol addiction. Blood lipid profile, Pulsed Doppler profile of right brachial artery blood flow velocities, Brachial arterial wall thickness, Blood pressure were measured. **Results:** In males there was significant correlation between Non HDL–C peak Systolic velocity (PSV), wall thickness (WT) and systolic Blood pressure (SBP) ($P< 0.01$) and End diastolic velocity (EDV) ($p<0.05$). Females in addition correlated significantly with diastolic blood pressure (DBP) ($p<0.05$) and without correlation with EDV. Total cholesterol (TC) in males were significantly correlated to PSV, EDV, WT and SBP ($p<0.01$). In females TC was significantly correlated to PSV, WT and SBP ($P<0.01$) and with DBP and Age ($P<0.05$). **Conclusion:** Our results show that females in Madurai develop higher risk for CHD from an early age than men because, Non-HDL-C was correlated significantly with SBP and DBP, SPV and WT, where as in men there was no correlation with DBP, and TC was additionally correlated significantly with DBP and Age in females and not in males. Early intervention with life style changes, Dietary modifications and exercise program may mitigate these risk factors for CHD.

Keywords: Arterial wall thickness, Blood flow velocity, Coronary Heart disease, Non-High density Lipoprotein.

INTRODUCTION

Non-high density lipoprotein cholesterol (Non-HDL-C) has been shown to be a predictor of initial coronary heart disease (CHD) events and also been associated with recurrent episodes of angina pectoris and nonfatal myocardial infarction (MI) in patients with multivessel coronary heart disease.[1,2] Non-HDL cholesterol is assessed by subtracting total cholesterol from HDL cholesterol which includes LDL cholesterol, very low-density lipoprotein (VLDL) cholesterol, intermediate-density lipoprotein (IDL) cholesterol, and lipoprotein (a) (LP(a)) all of which are circulating arthrogenic lipoproteins. Non–HDL cholesterol was shown to be an independent predictor of CHD regardless of the triglyceride level.[5] Several clinical studies have shown that arterial stiffness increases with age and hypercholesterolemia.[3,4] However non-HDL cholesterol affected arterial thicknessrather than arterial stiffness.[6-9] The increased arterial wall thickness(WT)is due to increase in the intima-media thickness (IMT).[7,10,11] Systolic blood pressure was found to be correlated with IMT.[12] In another study the IMT and End Diastolic velocity (EDV) in the carotid artery could jointly predict ischemic stroke. Significant and high correlations were found between Non-HDL cholesterol and systolic and diastolic blood pressure.[13] It is evident that CHD evolution is orchestrated by many interdependent factors and is more pronounced by the level of Non HDL-C. The National Cholesterol Education Program (NCEP) recommends that clinicians aim to reduce levels of non-high density lipoprotein (HDL)

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cholesterol as a secondary lipid-lowering target.[14] However there seem to be gender differences in lipid fractions and blood flow velocities, Women seem to have higher diastolic velocity components and lower systolic velocity components compared to men.[16] Madurai women have been show to develop dyslipidemias at an early age compared to men in the same region.[15] Accordingly this study was initiated to observe if there were gender differences in CHD risk factors particular Non HDL-C, blood pressure, Blood Flow Velocities and arterial wall thicknessto initiate an early intervention create and awareness in the more prone gender for CHD.

MATERIALS AND METHODS

All subjects who were inducted into this study were first time visitors to master health checkup clinic which is part of the OPD. 50 patients were included in this study of whom 26 were males and 24 were females. Medical history and personal data (blood pressure, weight, height and age) were recorded. Patients with significant past history of major illness were excluded,including dyslipidemias, Diabetes mellitus, hypertension, myeloproliferative disorders, cardiac diseases and alcohol addiction. Lipid profile, Ultra sonogram of the abdomen, were among the routine investigations of the master health checkup plan. Additionally for this study purpose blood flow velocitiesin the right Brachial artery weremeasured. Base line blood pressure was measured in the right upper arm in sitting position. For statistical purposes males and females were separately subdivided into four groups based on their age. Group 1 (age 22-32) Group 2 (age 33 to 42) Group 3 (age 43 to 52) Group 4 (age 53 to 62). The mean of individual variables from each group was graphically represented for comparison between male and female.

Pulsed Doppler sonographic measurements were carried out at the distal one-third of the right brachial artery, 1-2 cm proximal to the antecubital fossa while the subjects were in a lying position with the arm slightly abducted and the hand unclenched. The study was done in GE voluson P8 ultrasound machine (GE Medical Systems ,Milwaukee, U.S.A) using high frequency linear probe (7 -12 MHz) . B mode examination of vessel wall thickness , calcification and plaques were documented.The equipment was adjusted for filtering and gain to yield the most detailed information with no artifacts. The Doppler insonation angle was set under 60 degrees during velocity measurements. Flow parameters such as peak systolic maximum velocity (PSV) and enddiastolic minimum velocity (EDV) of each subject were measured .

For statistical analysis SPSS version 21 and Excel 2010 were used, Pearson's correlation was calculated for significance. P value < 0.05 was considered significant. Early intervention in women with life style changes

RESULTS

Table 1: Demographic details of respondents.

Demographic variables	Frequency (n)	Percent (%)
Gender		
Male	26	52.0
Female	24	48.0
Age group		
22-32	14	28.0
33-42	13	26.0
43-52	14	28.0
53-62	9	18.0

Table 2: Relationship between blood flow velocities, Wall thickness and cholesterol parameters of male respondents

	BA PSV	BA EDV	Wall thickness	Systolic BP	Diastolic BP	Age
TC	.728**	.510**	.598**	.812**	0.382	0.35
HDL	0.201	0.209	.468*	0.302	0.14	.437*
Non HDL	.722**	.501*	.567**	.816**	0.365	0.336

**P<0.01, *P<0.05

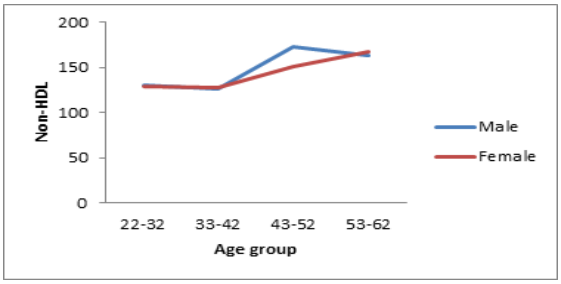

Figure 1: Gender wise non-HDL levels.

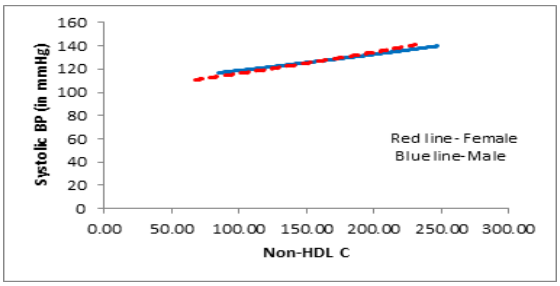

Figure 2: Gender wise relationship between Systolic Bp and Non-HDL C.

Statistical analyses are carried out in SPSS 20 version and MS-Excel. Percentage analysis is computed for demographic information of respondents and Pearson correlation analysis is used to ascertain the linear relationship between two variables.

50 subjects (n=50) were inducted into this study with 26 (52%) of them were males and 24 (48%) of them were females. Based on their age the maximum participants were found in 22-32 years age group and 43-53 years age group (28 % each) followed by 33-42 years age group (26 %) and 53-62 years age group (18 %) [Table 1].

Association between Non HDL–C and PSV, EDV, WT, SBP, DBP, Age

Non HDL–C in males correlated significantly with peak Systolic velocity (PSV) , wall thickness and systolic Blood pressure (SBP) (P< 0.01) and with Peak diastolic velocity (EDV) (p<0.05). Non HDL–C in females correlated significantly with peak Systolic velocity (PSV) , wall thickness (WT) and systolic Blood pressure (SBP) (P< 0.01) and with diastolic blood pressure (p<0.05).

Association between HDL–C and PSV, EDV, WT, SBP, DBP, Age

HDL-C in males correlated with wall thickness and age (P<0.05) and no correlations were found between HDL-C and wall thickness and age in females.

Table 3: Relationship between blood flow velocities, Wall thickness and cholesterol parameters of female respondents

	BA PSV	BA EDV	Wall thickness	Systolic BP	Diastolic BP	Age
TC	.565**	0.399	.576**	.631**	.480*	.406*
HDL	-0.094	0.119	0.112	-0.172	-0.069	0.058
Non HDL	.588**	0.372	.551**	.672**	.497*	0.393

**P<0.01, *P<0.05

Association between TC and PSV, EDV, WT, SBP, DBP, Age

Total cholesterol (TC) in males were significantly correlated to PSV, EDV, WT and SBP (p<0.01). In females TC was significantly correlated to PSV, WT and SBP (P<0.01) and with DBP and Age (P<0.05). [Table 2 & Table 3].

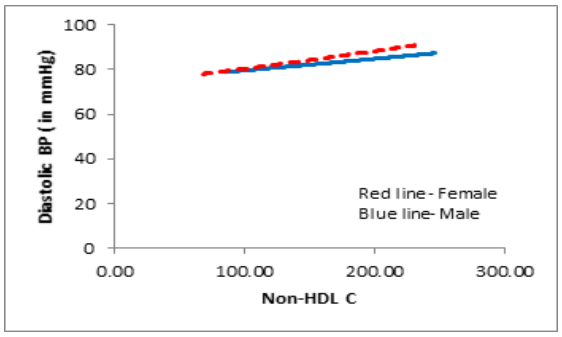

Figure 3: Gender wise relationship between Diastolic Bp and Non-HDL C

DISCUSSION

To our knowledge this is the first prospective study to investigate the relationship between NonHDL-C and PSV, EDV, WT, SBP and DBP. Wall thickeningat the early phase of atherosclerosis is related to atherogenic lipoproteins.In the males subjects increases in the Non HDL –C increased the wall thickness, resulting in increased SBP and both PSV and EDV. There was no relationship with DBP and Age. In contrast in the female subjects the Non HDL –C increased the arterial wall thickness, and increase of SBP, DBP and PSV. However it was not related to EDV or age [Table 2, 3]. Shear stress has been implicated in the pathogenesis of atherosclerotic lesions. Increase in blood pressure increases blood flow velocity which increases the momentum of RBC on the arterial wall increasing sheer stress resulting in intimal deposition of cholesterol into the wall leading to atherosclerosis.[19] Also hemodynamic alterations requiring an increase in blood pressure may provoke adaptive vascular remodeling and the attendant lower compliance of the vessel wall leading to lipoprotein efflux across the arterial wall and the development of atherosclerosis in the presence of dyslipidemia.[17,18] This indicates that the female subjects from Madurai seem to have a higher risk for CHD than men because SBP, DBP and PSV were in positive correlation with Non HDL-C compared to men where there was no correlation between non HDL-C and DBP [Figure 3].

When Mean Non HDL –C values were compared between male and female groups [Figure 1] the female show a steady increasing trend with Non HDL-C levels from an early age (33 to 42). Whereas men show a decreasing trend from Middle age (43 to 52).Total cholesterol increased with age along with SBP, DBP.PSV and WT in females the same was not evident in male where the total cholesterol did not increase with age and DBP. These findings indicate that the women from Madurai have a higher risk for CHD than men beginning at an early age, which agrees with our findings from our previous study where women require surgical cardiovascular intervention as compared to other women in India.[15]

Limitation

This study has a few limitations, Firstly this is an observational study and the sample size is very small. A study with larger population may yield better results for intervention. Secondly this study was performed only on population from Madurai district where generalizations are not justified. Finally the PSV and EDV were measured only once by experienced radiologist with good precision, we did not observe for the reproducibility of data.

CONCLUSION

Our present study observes that the female population develops risk for CHD at an early age compared to men from Madurai district. We recommend that women from this region be educated regarding their increased propensities for CHD risk and advised early lifestyle therapy with dietary modification with a robust exercise regimen. A reduction in total calories, with brisk walking for

weight reduction may be feasible in working women. omega-3 fatty acid-containing capsules should be provided for those women who cannot afford diets rich in omega-3 fatty acid. This may be included in the Governmental health care policy in CHD prevention programs.

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