

ORIGINAL ARTICLE

Analysis of Association of Various Risk Factors with Atherosclerosis through Carotid Intima-Media Thickness Measurement

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Abstract

Introduction: Atherosclerosis remains the major cause of death and premature disability in developed societies. Cardiovascular risk is amplified multifold in post-menopausal women. Carotid intima-media thickness (CIMT) is non-invasive, reproducible, economical, safe contrivance to analyze amassed effect of various risk factors for atherosclerosis. **Aims and Objectives:** The present study was undertaken to find out prevalence of dyslipidemia in postmenopausal women coming from rural area to the tertiary care hospital for any illness, estimate CIMT in these women and to find out correlation between dyslipidemia and abnormal CIMT, to find the prevalence of other CAD risk factors. **Materials and Methods:** The present study was cross sectional observational study, which measured CIMT through B- mode ultrasonography on common carotid artery. **Results:** Out of 87 dyslipidemics, 13 had raised CIMT. Diabetes mellitus and coronary artery disease showed statistically significant association with raised CIMT. **Conclusion:** CIMT findings showed that it may be considered as sensitive but not specific marker of atherosclerosis.

Keywords: Atherosclerosis, Cardiovascular Risk factors, Carotid intima-media thickness (CIMT)

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Introduction

Atherosclerosis remains the major cause of death and premature disability in developed societies.^[1] Cardiovascular risk factors are encountered more with advancing age, irrespective of sex. But this risk is amplified multifold in post-menopausal women.^[2,3] Plasma lipid and lipoprotein metabolism are significantly affected in post-menopausal women owing to hormonal changes like decreased estrogen, raised follicular stimulating hormone and luteinizing hormone.^[4] In past few decades lifestyle related diseases are on the rise, not only in urban, but also in rural population also.^[5] Conventional atherosclerotic risk factors account only for half of the risk for cardiovascular diseases (CVD) and existing investigations are based on evaluation of these risk factors. Hence now focus is shifting on

newer risk factors which will predict CVD with more specificity and sensitivity, one being carotid intima-media thickness (CIMT).^[6] It is the accessible space between tunica media and tunica adventitia.^[7] CIMT is non-invasive, reproducible, economical, safe contrivance to analyze amassed effect of various risk factors for atherosclerosis.^[8] Its values convalesces with beneficial atherosclerotic preventive treatments and is also a sovereign forecaster of myocardial infarction (MI) and stroke risk.^[9] Atherosclerosis is fast-tracked in post-menopausal women and this is attributed to decline in cardio-protective effects of estrogen, including increasing high density lipoprotein (HDL), reducing low density lipoprotein (LDL) levels, reduction in size of atherosclerotic plaque.^[10] Many studies have been done on menopausal women regarding atherosclerotic risk factors, But there is dearth of studies in Central India, hence present study

was planned with the intention to find out prevalence of dyslipidemia in postmenopausal women coming from rural area to the tertiary care hospital for any illness, to estimate CIMT in these women and to find out correlation between dyslipidemia and abnormal CIMT and to find the prevalence of other CAD risk factors in this study group.

Materials & Methods

It was a cross sectional one year study (from September 2015 to August 2016), conducted at NKP Salve Institute of Medical Sciences & Lata Mangeshkar Hospital, Nagpur (M.S.). After ethical clearance and written informed consent, 100 cases were included in the study.

Post-menopausal women of rural background admitted to Medicine ward of above-said hospital, irrespective of duration of menopause were part of the study while those who were already on lipid lowering treatment and who had some secondary cause for dyslipidemia like nephrotic syndrome or hypothyroidism were excluded from the study.

Brief history of current illness, history of major illnesses like diabetes, hypertension, ischemic heart disease, stroke etc was recorded. History of physical activity was taken and women were categorized as sedentary or physically active. Dietary habits, whether consuming pure vegetarian diet or mixed (vegetarian plus non-vegetarian) diet was asked and the type and quantity of cooking oil consumed per person was also asked. Details of habits like alcohol, smoking and tobacco chewing were noted.

Duration of menopause in each woman was noted. Detail physical examination and anthropometric measurements (height, weight, waist circumference, Body Mass Index) was also done.

Fasting lipid profile, fasting and post lunch sugar, urea, creatinine, TSH were done from hospital laboratory. ECG was done in all. 2D Echo and CT brain was done wherever indicated. CIMT was measured by using B mode ultrasonography machine. Measurements were done on longitudinal section of common carotid artery at 1cm distance from bifurcation of the artery with subject lying down head extended and slightly turned to opposite side of the artery examined. CIMT was measured on both sides and higher value was taken as CIMT.

Values above 0.9mm were considered abnormal and are indicative of atherosclerotic thickening of the artery.^[11]

Statistical analysis

Chi square test was applied to find out the significant difference amongst variables and risk ratio with 95% confidence interval is used to describe the strength of association. Fisher exact test was applied where one of the cells have values less than 5 or zero. P value of less than 0.05 was considered statistically significant.

Defining criteria

- Dyslipidemia- Abnormalities in serum lipid levels, measured after 12 hours overnight fast are termed as dyslipidemia.
- Normal values of lipids as per modified National Cholesterol Education Programme Adult treatment Panel III(NCEP ATP III) **Guidelines:** Total Cholesterol (TC) up to 200mg%, Low Density Lipoprotein (LDL) cholesterol upto 130 mg%, Triglycerides (TG) upto 150 mg% and High Density Lipoprotein (HDL) cholesterol in females more than 50mg%.

Results

In the present study, 20 women were in the age group 41 to 50 years and average duration of menopause in this group was 5.3 years. Age group 51 to 60 years included 43 women with average duration of menopause being 11.76 years, while 32 women were in the age group 61 to 70 years and average duration of menopause was 18.53 years. 5 women were in age group >70 years with average duration of menopause being 31 years (Table 1).

Table 1: Distribution of patients according to age & duration of menopause.

| Age (years) | Number of patients (n=100) | Average duration of menopause (years) |
|--------------|----------------------------|---------------------------------------|
| 41-50 | 20 | 5.3 |
| 51-60 | 43 | 11.76 |
| 61-70 | 32 | 18.53 |
| >70 | 5 | 31 |
| Total | 100 | |

59 women were pure vegetarian by diet and 85 used soya bean oil for daily cooking. Maximum women led a sedentary lifestyle (65). Body mass index measurements showed maximum women

in obese group (35 women) followed by 29 in normal weight and 9 women in grossly obese group (Table 2).

Table 2: Parameters studied in study population.

| Parameters | No. of patients (n=100) |
|---|-------------------------|
| <u>Dietary habits-</u> | |
| i. Pure vegetarian | 59 |
| ii. Mix (veg + non-vegetarian) | 41 |
| <u>Oil Consumed daily-</u> | |
| i. Soyabean | 85 |
| ii. Groundnut | 12 |
| iii. Flaxseed | 2 |
| iv. Palm | 1 |
| <u>Physical activity-</u> | |
| i. Sedentary | 65 |
| ii. Physically active | 35 |
| <u>Body Mass Index-</u> | |
| i. < 18.4 (underweight) | 12 |
| ii. 18.5-22.9 (normal) | 29 |
| iii. 23-24.9 (overweight) | 15 |
| iv. 25-30 (obese) | 35 |
| v. > 30 (gross obesity) | 9 |
| <u>Waist Circumference-</u> | |
| i. >88 cm | 19 |
| ii. <88 cm | 81 |
| <u>Lifestyle associated comorbid diseases-</u> | |
| i. Diabetes mellitus | 32 |
| ii. Hypertension | 56 |
| iii. Coronary artery disease | 14 |
| iv. Cerebrovascular accident | 4 |
| v. ≥ 2 diseases | 27 |

Associated diseases included in descending order of number of patients- hypertension (56 women), diabetes mellitus (32), having ≥2 diseases (27), coronary artery disease (14). Amongst lipid abnormalities, maximum women had decreased HDL (89 women), followed by raised TG (33), increased LDL (32). CIMT was raised in 13 women (Table 3).

These 13 women also had lipid abnormalities and this was highly statistically significant with $p < 0.01$ (Table 4).

Out of 44 obese women 42 (95.5%) had abnormal lipid profile and 8 (18.1%) had raised CIMT and this was not statistically significant (Table 5).

Table 3: Lipid levels & (CIMT) measurements in study population.

| Parameters | (n=100) |
|---|---------|
| <u>Lipid abnormalities-</u> | |
| i. Total cholesterol (TC)>200 | 25 |
| ii. LDL >130 | 32 |
| iii. HDL <50 | 89 |
| iv. Triglycerides (TG)>150 | 33 |
| v. TC >200 + TG >150 | 18 |
| <u>Carotid intima media thickness-</u> | |
| i. ≤ 0.9 mm | 87 |
| ii. >0.9 mm | 13 |

Table 4: Correlation between lipid profile & CIMT.

| LP | CIMT | | Total |
|--------------|-----------|-----------|------------|
| | Raised | Normal | |
| Abnormal | 13(100%) | 74(85%) | 87 |
| Normal | 0(0%) | 13(15%) | 13 |
| Total | 13 | 87 | 100 |

Table 5: Correlation between obesity, dyslipidemia and abnormal CIMT.

| Parameter | Abnorma I LP | Abnorma I CIMT |
|-----------------------|--------------|----------------|
| Obesity(BMI>25)n=44 | 42(95.5%) | 8(18.1%) |
| Non-obese(BMI<25)n=56 | 43(76.7%) | 5(8.9%) |

Amongst associated comorbid diseases 6 of 56 (10.7%) patients with hypertension had raised CIMT and this was not statistically significant ($p > 0.05$), while 9 of 32 (25%) having DM had raised CIMT which was statistically significant association ($p < 0.01$). 8 out of 14 (57%) women with CAD had increased CIMT and this association was statistically highly significant ($p < 0.01$; Table 6)

Table 6: Association of lifestyle associated diseases with abnormal CIMT values.

| Disease | Abnormal CIMT | P value |
|--------------------------------|---------------|---------|
| Diabetes Mellitus (n=32) | 9 (28%) | <0.01 |
| Hypertension (n=56) | 6 (10.7%) | > 0.05 |
| Coronary Artery Disease (n=14) | 8 (57%) | < 0.01 |
| Cerebrovascular accident (n=4) | 1 (25%) | > 0.05 |

Discussion

In the present study maximum women were having sedentary lifestyle, which has been linked to atherosclerosis and cardiovascular morbidity.^[12] Maximum women used soya-bean oil for daily cooking since it is the cheapest and readily available edible oil in this part of Maharashtra. Soya bean oil has good $\omega 3:\omega 6$ ratio. Such parameters are studied so as to modify them to reduce cardiovascular morbidity and mortality, as indicated in one study.^[13] Approximate quantity used per person per month was 1 liter, which is quite acceptable. Hypertension and DM were most common associated diseases in the present study, which is in accordance with other such study.^[14] In the present study maximum women had decreased HDL followed by increased TG and LDL. These results are comparable with findings of various studies conducted elsewhere.^[15, 16] Various studies have linked decreased HDL to atherosclerosis and hence cardiovascular morbidity.^[17, 18] This is supported by the fact that HDL mitigates atherogenic activity of LDL by promoting reverse cholesterol transport and this was postulated in the Framingham Heart Study. In the present study 13 dyslipidemic women had raised CIMT, but rest 74 dyslipidemic women had CIMT within normal limits. Thus it can be inferred that dyslipidemia is sensitive but not a specific marker of raised CIMT. These abnormalities and risk factors are amplified in postmenopausal women, as indicated in various studies.^[19] Obesity in the present study was found out to be 44% and these results are comparable to other such study.^[20] Out of these, 95% had dyslipidemia but only 18% had raised CIMT, thus indicating that obesity and atherosclerosis are independent cardiovascular risk factors. CIMT in the present study, was significantly associated with DM and CAD. This is supported clinically by the fact that, atherosclerosis is associated with both, DM and CAD. All these effects are amplified in postmenopausal women, as seen in various studies conducted in western world. Such study found out that prevalence of carotid atherosclerosis in post-menopausal women was more than that of pre-menopausal women. This is attributed to low estrogen levels, reduced sex hormone binding globulin and total testosterone levels.^[10]

Conclusion

Among the factors, dyslipidemia is most commonly associated with atherosclerosis. CIMT findings indicate that it may be considered as sensitive but not specific marker of atherosclerosis in this regional population.

Conflict of Interest: None declared

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Ethical Permission: Obtained

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