Original Research Article

Dyslipidemia is the hallmark of the metabolic syndrome in postmenopausal women

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Abstract

The incidence of cardiovascular diseases (CVD) increases after menopause and may be due to changes in the plasma lipid-lipoprotein levels that occur following menopausal transition. Physiological estrogen withdrawal during menopause plays a major role in abnormal lipid metabolism such as elevated low-density lipoprotein concentration. The aim of this study was to determine the relationship between dyslipidemia and the causative factors of metabolic syndrome in postmenopausal women. In this cross-sectional study, 290 postmenopausal Sudanese women were included. Lipid profiles were measured by spectrophotometer, estrogen hormone determined by ELISA, insulin resistance determined by HOMA-2 calculator and lipid accumulation product was calculated by the following equation (waist circumference in cm X triglyceride concentration in mM). The results revealed that total cholesterol, triglycerides, low-density lipoprotein levels and very low-density lipoprotein levels were significantly higher in the postmenopausal women with metabolic syndrome (MS) in comparison to those without the MS. Elevated total cholesterol levels were seen in 51.7 %, elevated triglycerides were seen in 49.7% and elevated low-density lipoprotein levels were seen in 29.3% whereas reduced high density lipoprotein levels were seen in 16.89% of the postmenopausal women. Total cholesterol, triglycerides and very low-density lipoprotein values showed a significant positive correlation with insulin resistance and lipid accumulation and a significant negative correlation with the estrogen hormone level. In addition, high density lipoproteins showed a significant negative correlation with lipid accumulation levels.

Keywords

Estrogen
Hyperlipidemia
Insulin resistance
Postmenopausal women

Introduction

Dyslipidemia is a major risk factor cardiovascular disease (CVD) that represents the main cause of death among postmenopausal women [1]. High level of total cholesterol (TC), low-density lipoprotein (LDL) and triglycerides (TG) are seen frequently in postmenopausal women (PMW) [2]. Observational studies that were carried out to compare lipid profile in women showed a slight but significant reduction in the high density lipoprotein (HDL) as well as an increase in TG and LDL levels in postmenopausal women when compared to premenopausal women [3]. However, Kuller et al observed that the LDL concentrations remain constant in women during menopausal transition, in addition they documented that in postmenopausal women with very low blood
4. Blood pressure of > or = 130/85 mmHg.

5. Fasting glucose of > or = 110 mg.

Dyslipidemia diagnosed by using updated diagnostic criteria adopted by NCEP-ATPIII that defined dyslipidemia as: TC > 200 mg/dl, LDL-C > 100 mg/dl and TG >150mg/dl.

**Statistical analysis**

Statistical analyses were performed by SPSS version 25 (IBM SPSS Inc., Chicago, IL, USA). Descriptive statistics was employed in this study, results presented as means ± standard deviations (Mean ± SD). Independent samples t-test was conducted to compare the relationship between dyslipidemia and MS. Pearson correlation was computed to estimate associations between the variables. P value less than 0.05 was considered significant.

**Results**

Results are presented in the Table 1 showing that total cholesterol, TG, LDL and VLDL were significantly higher in the postmenopausal women with MS relative to the group without MS (p<0.000). HDL was significantly low in the postmenopausal women with MS (p=0.011).

| Lipid profile | PMW with MS (n=149) | PMW without MS (n=141) | P value |
|---------------|---------------------|------------------------|---------|
| TC (mg/dl)    | 208.75±50.22        | 183.79±44.65           | 0.000   |
| TG (mg/dl)    | 209.49±85.12        | 125.54±51.19           | 0.000   |
| HDL (mg/dl)   | 80.35±38.15         | 90.82±31.59            | 0.011   |
| LDL (mg/dl)   | 87.48±40.87         | 69.47±37.20            | 0.000   |
| VLDL (mg/dl)  | 41.20±17.83         | 25.06±10.50            | 0.000   |

Table 2 shows the prevalence of dyslipidemia among postmenopausal women. More than one-half of the subjects (n=150) had elevated TC levels (51.7%). Elevated TG levels were seen in 49.7% (n=144) of the subjects. Elevated LDL levels were seen in 29.3% (n=85) of the subjects. Reduced HDL levels were seen in 16.9% (n=49) of the subjects.

| Dyslipidemia | N=290 | %     |
|--------------|-------|-------|
| TC ≥200 mg/dl| 150   | 51.7  |
| TAG ≥150mg/dl| 144   | 49.7  |
| LDL ≥100 mg/dl| 85    | 29.3  |
| HDL ≤50mg/dl (F) | 49    | 16.9  |
Table 3 shows that TC, TG and VLDL values positively correlated with insulin resistance and LAP; on the other hand negatively correlated with estrogen level. HDL significantly negatively correlated with LAP.

| Parameters | Statistics (Pearson correlation) | Estrogen | HOMA2-IR | LAP |
|------------|---------------------------------|----------|----------|-----|
| TC         | r                               | -0.271   | 0.227    | 0.242 |
|            | p (2 tailed)                    | 0.000    | 0.000    | 0.000 |
| TG         | r                               | -0.342   | 0.336    | 0.870 |
|            | p (2 tailed)                    | 0.000    | 0.000    | 0.000 |
| HDL        | r                               | -0.040   | 0.050    | -0.170 |
|            | p (2 tailed)                    | 0.496    | 0.396    | 0.004 |
| LDL        | r                               | -0.154   | 0.096    | 0.117 |
|            | p (2 tailed)                    | 0.009    | 0.101    | 0.046 |
| VLDL       | r                               | -0.314   | 0.303    | 0.778 |
|            | p (2 tailed)                    | 0.000    | 0.000    | 0.000 |

indicating the major role played by hypoestrogenism for the development of dyslipidemia. In addition, LAP which represent enlarged adiposity significantly positively correlated with TC, TG, LDL and VLDL, and negatively correlated with HDL. These findings directly explain the role of enlarged central adiposity in the development of dyslipidemia among postmenopausal women.

The state of insulin resistance that occurs in the postmenopausal women with MS regarded as a trigger factor for development of dyslipidemia. In the presence of insulin resistance the visceral adipocytes fail to respond to lipolytic effect of insulin, so that large amount of free fatty acids released into the hepatic cells leading to disproportionate production of TG and TG rich VLDLs [14] which consequently leads to increased production of apo-B — the major protein of LDL [15]. In the present study insulin resistance positively correlated with TC, TG and VLDL confirming the central role of insulin resistance state in the development of dyslipidemia and metabolic syndrome in our subjects.

**Conclusion**

Postmenopausal hyperlipidemia occurs as a direct consequence of metabolic syndrome due to state of hypoestrogenism that leads to enlargement of central adiposity and insulin resistance. It warrants management of these conditions which will prevent the development of CVD in postmenopausal women.

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