

Dyslipidaemia in woman with polycystic ovarian syndrome: A case control study in tertiary care hospital of Karachi

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Abstract

Objective: To compare lipid profile in lean and obese women with polycystic ovary syndrome with normal weight and obese controls.

Method: The case-control study was conducted at the Department of Chemical Pathology, Liaquat National Hospital, Karachi, from March 2006 to April 2007. It comprised 50 cases of polycystic ovary syndrome along with 50 healthy controls matching for age, gender and weight. SPSS 14 was used for statistical analysis.

Result: The mean fasting levels of triglyceride and Low density lipoprotein cholesterol were considerably higher in women with polycystic ovary syndrome than those in the control group ($p < 0.05$), while high-density lipoprotein cholesterol was significantly low in patients than the controls ($p < 0.001$). Obese patients had high triglyceride value ($p < 0.05$). There was significant interaction between polycystic ovary syndrome, obesity and triglyceride levels ($p < 0.05$).

Conclusion: Polycystic ovary syndrome is associated with a more pronounced atherogenic lipid profile. Lipid parameters were adversely affected in a subgroup that was obese. As such, women with polycystic ovary syndrome are at high risk of developing cardiovascular disease due to the presence of dyslipidaemia.

Keywords: Dyslipidaemia, Obesity, PCOS, Cardiovascular risks. (JPMA 64: 1049; 2014)

Introduction

The polycystic ovary syndrome (PCOS) is one of the most common endocrine diseases in women, affecting up to 8% of women in reproductive age.¹ PCOS is characterised by chronic anovulatory cycles, oligo- or amenorrhea, hirsutism, and insulin resistance, while obesity is also common. PCOS not only has a negative effect on fertility, but it is also considered a clear-cut plurimetabolic syndrome being associated with type 2 diabetes mellitus (T2DM), hypertension, and dyslipidaemia.²

Cardiovascular disease is the most common cause of death in women,³ and those with PCOS have an increased risk for coronary artery disease (CAD),⁴ calculated by risk factor analysis due to the prevalence of glucose intolerance, hypertension, insulin resistance (IR), central obesity and dyslipidaemia.⁵ At least, one abnormal lipid level is seen in 70% of women with PCOS.⁶ Dyslipidaemia is characterised by low levels of high-density lipoprotein cholesterol (HDL-C) and raised triglyceride (TG).⁷ It may explain the increased cardiovascular risk for the PCOS patients, particularly as low HDL-C appears to be the most important lipoprotein predictor of coronary heart disease (CHD) in women.⁸

The PCOS and cardiovascular diseases are common in

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women, and age remains one of the risk factors for the development of atherosclerosis and death from cardiovascular events. As a syndrome, it has multiple components — reproductive, metabolic, and cardiovascular — with health implications throughout the life. Dyslipidaemia, diabetes and obesity are all potent cardiovascular risks that tend to cluster in women with PCOS.¹ The question relates to whether the cardiovascular risks are common at an earlier age in PCOS and dependent on obesity or the result of other metabolic factors. The present study was planned to determine the lipid profile in women with PCOS in order to identify the cardiovascular risk early.

Patients and Methods

The prospective case-control study was conducted at the Department of Chemical Pathology, Liaquat National Hospital (LNH), Karachi, from March 2006 to April 2007. It comprised 50 cases of PCOS alongside 50 healthy controls matched for age, gender and weight. The cases were diagnosed to have PCOS using Rotterdam European Society for Human Reproduction and Embryology (ESHRE)/American Society for Reproductive Medicine (ASRM) PCOS group's revised 2003 criteria.⁹ These criteria comprised a) Oligo and/or anovulation; b) clinical and/or biochemical signs of hyperandrogenism; c) polycystic ovaries with the exclusion of congenital adrenal hyperplasia androgen secreting tumour. The presence of two of these three conditions was good enough for PCOS

diagnosis. Patients with any specific diseases of adrenal, thyroid or pituitary nature, any systemic illnesses like diabetes, hypertension, renal disease, and those on oral contraceptives, lipid-lowering drugs or antiepileptics were excluded. Written consent was obtained from all concerned. After a detailed clinical history and physical examination, hormonal and radiological investigations were recorded. Body mass index (BMI) was calculated and blood sampling was done for total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) in fasting state. Follicle stimulating hormone (FSH), leutinising hormone (LH), and testosterone were determined if not already done.

Levels of plasma fasting TC, LDL-C, HDL-C and TG were determined by the Enzymatic calorimetric method, using random access Hitachi auto analyser 912 (Roche Diagnostics).

SPSS 14.0 was used for statistical analysis. Results were expressed as mean \pm Standard Deviation. To determine the difference between mean TC, TG, LDL-C and HDL-C levels of the cases and the controls, independent sample t-test was used. Mann-Whitney U tests were used for comparison of parameters that were not normally distributed. A two-way analysis of variance (ANOVA) was performed to determine the effect of PCOS and obesity and possible interaction between PCOS and obesity on lipid profile. $P < 0.05$ was considered statistically significant. However, exact p values were reported.

Results

Among the 50 PCOS cases studied, 46(92%) had oligomenorrhea, 4(8%) had amenorrhea. Hirsutism was present in 21(42%) patients and ultrasonic evidence of PCOS was seen in 44(88%). All the controls were healthy, had normal menstruation, and no one had a history of hirsutism. Among the patients, 27(54%) were married,

Table-1: Hormonal characteristics of cases and controls.

Variables	PCOS	Controls	p-value
N	50	50	
Mean Age (years)	27.02 \pm 4.66	27.40 \pm 4.99	NA
BMI (kg/m ²)	26.34 \pm 5.72	25.87 \pm 5.57	NA
TC(mg/dl)	156.30 \pm 34.95	143.56 \pm 24.67	0.156
TG(mg/dl)	123.50 \pm 55.05	95.26 \pm 33.08	0.002
LDL (mg/dl)	97.66 \pm 26.51	88.86 \pm 15.83	0.047
HDL(mg/dl)	35.24 \pm 10.12	43.00 \pm 7.81	<0.001
FSH(ml U/ml)	5.09 \pm 1.70	5.05 \pm 1.18	0.141
LH (ml U/ml)	9.43 \pm 7.16	3.26 \pm 1.12	<0.001
Testosterone(ng/ml)	0.14 \pm 0.21	0.06 \pm 0.06	0.010

NA: not applicable

PCOS: Polycystic ovary syndrome

BMI: Body mass index

TC: Total cholesterol

TG: Triglycerides

LDL-C: Low-density lipoprotein cholesterol

HDL-C: High-density lipoprotein cholesterol

FSH: Follicle stimulating hormone

LH: Leutinising hormone.

and of them, 9 (33%) suffered from infertility, either primary or secondary. In terms of lipid profile, 40(80%) of the cases had at least one abnormal lipid level. The frequencies of individual lipid abnormalities revealed that 33(66%) patients had decreased/borderline HDL-C (<40mg/dl), 6(12%) had elevated LDL-C (>130mg/dl), and 12(24%) had elevated TG (>150mg/dl), and 6(12%) had elevated TC (>200mg/dl).

The overall clinical and hormonal results of patients with PCOS and controls showed that the mean fasting levels of TG and LDL-C were significantly higher in women with PCOS than the controls ($p < 0.05$), while HDL-C was significantly low in the patients than the control ($p < 0.001$). LH and testosterone levels were also significantly higher in the cases.

Table-2: Hormonal characteristics of obese and non-obese cases and controls.

	PCOS Obese	Non-obese	Controls Obese	Non-obese	p-values PCOS	Obesity	Interaction
BMI	30.13 \pm 4.78	21.53 \pm 1.97	29.92 \pm 4.57	21.48 \pm 2.18	NA	NA	NA
Cholesterol	163.5 \pm 36.25	140.45 \pm 44.43	142.38 \pm 21.69	144.83 \pm 27.98	0.214	0.127	0.60
Triglyceride	144.29 \pm 60.01	97.05 \pm 33.67	87.88 \pm 33.51	103.25 \pm 31.36	0.004	0.640	0.001
Low density lipoprotein	100.86 \pm 28.17	93.59 \pm 24.27	91.58 \pm 15.25	85.92 \pm 16.26	0.560	0.143	0.855
FSH	5.31 \pm 1.59	4.82 \pm 1.84	5.0 \pm 0.98	5.11 \pm 1.39	0.974	0.518	0.312
Testosterone	0.17 \pm 0.28	0.11 \pm 0.08	0.07 \pm 0.09	0.05 \pm 0.03	0.014	0.176	0.583

NA: not applicable

Variables were analyzed by 2- way ANOVA.

PCOS: Polycystic ovary syndrome

BMI: Body mass index

FSH: Follicle stimulating hormone.

According to their BMI, the patients and the controls were divided into two subgroups; non-obese = BMI < 25 kg/m²; and obese = BMI > 25 kg/m².

When compared with obese PCOS subject, non-obese PCOS subjects had lower TG levels ($p < 0.05$). Levels of TC, LDL-C, FSH, LH and testosterone were not significantly different between an obese and non-obese patient with and without PCOS (Table-2). There was significant interaction between PCOS, obesity and TG levels ($P < 0.001$).

Discussion

The results showed that the prevalence of dyslipidaemia in our population with PCOS was quite high. Dyslipidaemia may be the most common metabolic problem in PCOS, but the type and extent of the findings have been variable. In our study, 80% of PCOS patients had at least one abnormal lipid level. This was approximately in accordance with the proven fact that prevalence of an abnormal lipid level (borderline or high) by National Cholesterol Education Programme (NCEP) guidelines approaches 70%.⁶ In our study, as determined by NCEP cutoffs, the mean levels of individual lipid parameters were within normal limits, although dyslipidaemia was documented similar to multiple previously published studies.^{6,10}

The most common type of dyslipidaemia (66%) in our population was low HDL-C (<40 mg/dl), which was the most significant finding because the plasma concentration of HDL-C is a significant independent predictor of risk for CHD.¹¹ Hypertriglyceridaemia (TG > 150 mg/dl) was the second most common dyslipidaemia (24%) found in our population.

Hypercholesterolaemia (TC > 200 mg/dl) was seen in only 12% of the patients, while 12% patients had elevated LDL-C using the cutoff of 130 mg/dl.

The present study confirms the presence of a more atherogenic lipid profile in women with PCOS. We found higher levels of TG and LDL-C in combination with decreased HDL-C in women with PCOS compared to the healthy controls. Other studies have reported similar findings of raised TG and reduced HDL-C levels in women with PCOS, a finding typically indicative of insulin resistance.^{10,12-14}

Obesity is frequently present in PCOS patients between 30-75%.¹ It is well known that obesity influences lipid profile independently of the presence or absence of PCOS. Our study showed dyslipidaemia in women with PCOS, which was evident especially in the obese women.

Serum TG was increased significantly in obese subjects compared to non-obese PCOS and weight-matched controls. A study found that obese PCOS and control subjects had higher levels of cholesterol, TG, Apolipoprotein B (Apo B), and fatty acids than their lean counterparts.¹⁵ Another study showed higher serum levels of TG, TC, LDL-C, and Apo B in combination with lower levels of HDL-C and Apo A-I in obese PCOS cases when compared with obese controls.¹⁶ One study found an increase in TC and a decrease in HDL-C levels as major findings, but did not find any increase in TG levels.¹⁷ Another study found no significant difference between lipid profile of obese PCOS patients and obese controls.¹⁸ Elevation in LDL-C levels as the predominant lipid abnormality in women with PCOS independent of obesity has also been reported.⁶ One study found no statistically significant difference in lipid profile between obese PCOS cases and obese controls.¹⁹

Many studies showed that abnormal lipid profile is a possible risk factor for cardiovascular disorder. Long-term observational studies, such as the Framingham Heart Study and the Prospective Cardiovascular Munster Study, have shown conclusively that low HDL-C levels are associated with increased CAD risk.¹¹ The significance of raised TG concentrations in relation to cardiovascular disease is debatable, but high TG measurements in obese PCOS may be related to the increased risk of CHD in obese population in general.²⁰ Elevation in LDL-C contributes to the excess risk of cardiovascular disease reported in this syndrome. Raised LDL-C in PCOS patients has been reported previously in various studies.¹³

Conclusion

The study was able to find the presence of dyslipidaemia in young women with PCOS, and the obese PCOS was the most affected group. The finding emphasises the importance of dyslipidaemia screening in young women with PCOS for early identification of cardiovascular risk and lifestyle modifications in order to prevent long-term health risks.

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