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Original Research Article

Study of different aspects of polyendocrine metabolic ovarian syndrome in females of reproductive age group

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ABSTRACT

Background: PMOS is most common hormonal disorder in females of reproductive age group. In PMOS many pearl sized cysts are formed in the ovaries. These cysts contain immature eggs. High LH, low FSH, high Testosterone in PMOS causes changes in physical appearance, irregularity in menstrual cycle and if not treated in time, leads to diabetes and strokes, obesity, mood disorder, endometrial cancer and sleep apnoea. The aim of the present study was to find out the clinical features, biochemical and hormonal profile of patients with PMOS.
Method: An observational, comparative study was conducted in the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology, Govt. Medical College and Hospital, Amritsar after taking approval from institutional ethical committee. The study group included 25 patients clinically diagnosed as patients of polycystic ovary disease, between age group 14-35 years. 25 age and sex matched healthy volunteers were included as control.
Result: Levels of LH, Prolactin, Testosterone were increased significantly in PMOS patients whereas changes in TSH were not significant. The FSH was significantly lower in the study group. Levels of Insulin and C-peptide were raised in PCOS patients.
Conclusion: From present study it is observed that PMOS patients are usually overweight, have menstrual irregularities, difficulty in conception, have oily skin, acne, hirsutism, hyperandrogenaemia, insulin resistant and have altered LH to FSH ratio, patients also have sleep disturbances, mood swings. The present study concludes that PMOS not only affect the physical quality of life, but it also affects mental and social life.

Keywords: Polyendocrine metabolic ovarian Syndrome, Luteinizing Hormone, Follicular Stimulating Hormone, Prolactin, Hirsutism, Androgens, Amenorrhea, Oligomenorrhea, BMI, Obesity

INTRODUCTION

Polyendocrine metabolic ovarian Syndrome (PMOS) is the most prevalent endocrinal disorder which affects women of reproductive age, usually between 14 and 35 years old. It is characterised by abnormal levels of reproductive hormones, which result in irregular menstruation cycles, ovarian cysts, and metabolic anomalies. Women with PMOS have many small cysts in their ovaries so it is called polycystic ovary syndrome. These cysts are not harmful but can lead to hormonal imbalance. The clinical features of PMOS are irregular or missing periods, amenorrhea, oligomenorrhea, dysfunctional uterine bleeding, acne, hirsutism, obesity, and hormonal imbalance which can lead to reproductive issues, complicating conception. Many women with PMOS also have obesity resulting in insulin resistance, which means the body's cells show less responsiveness to insulin, resulting in increased blood sugar levels and increased chance of Type 2 diabetes mellitus. Women with PMOS have increased chances of cardiovascular diseases, hypertension, metabolic problems, obstructive sleep apnoea, depression, non-

alcoholic fatty liver disease, endometrial hyperplasia and endometrial carcinoma, etc. These symptoms adversely impact overall health and lead to a reduced quality of life. The rising incidence of PMOS demands the need for more awareness and a comprehensive strategy for controlling its consequences. Early diagnosis and treatment can help control the symptoms and prevent long term problems. In other words, polycystic ovary syndrome (PMOS/PCOS) is a problem in which a woman's hormones are out of balance. It causes problems with their periods and makes it difficult to get pregnant. If it is not treated, over time it can lead to serious health problems, such as Diabetes and Heart disease.

A Normal woman's ovaries, have tiny fluid-filled sacs called follicles or cysts. As the egg grows, these follicles build up fluid. The size of a mature follicle is about 18 to 28 mm in diameter. This mature follicle is cystic in structure, and it is ready to ovulate. When the egg matures, the follicle breaks down and the egg is released, and the egg travels through the fallopian tube to the uterus for fertilization. This is called ovulation. In women with PMOS, the ovary doesn't make all of the hormones in proper concentration, so the egg doesn't get fully mature. The follicles may start to grow and build up fluid, but ovulation does not occur. Instead, some follicles may remain as cysts. For these reasons, ovulation does not occur and the hormone progesterone is not released. Without progesterone, a woman's menstrual cycle is irregular or absent. The ovaries make male hormones, which also prevent ovulation. So, the main difference between polycystic ovaries and normal ovaries is that the polycystic ovaries contain many small follicles with eggs, but these do not mature properly- so there is no ovulation. Since women with polycystic ovaries do not ovulate regularly, they do not get regular menstrual periods.[1,2] Women with polycystic ovaries often have an excess amount of the male hormones testosterone and androstenedione, result in high testosterone levels in the blood this leads to increased facial and body hair growth.[3,4]

Recently, the European Society for Human Reproduction and Embryology (ESHRE) and the American Society for Reproductive Medicine (ASRM) achieved a new consensus regarding the definition of PMOS which is now defined as the presence of any two of the following three criteria: polycystic ovaries, oligo- /anovulation and/or, clinical or biochemical evidence of hyperandrogenism.[5]

According to WHO PMOS affects 116 million women worldwide (3.4 % of women). In the Indian population the prevalence of menstrual irregularities in women with PMOS is 14.6- 22.8% and irregularities range from amenorrhea to menorrhagia. Insulin resistance has main role in the pathogenesis of PMOS and Indians are known to have high prevalence of insulin resistance, so the prevalence of PMOS is expected to be high in the Indian population.[6] So, the aim of the present study was to find out the clinical features, biochemical and hormonal profile of patients with Polyendocrine metabolic ovarian Syndrome (PMOS).

METHODS

An open, observational, comparative study was conducted in the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology, Govt. Medical College and Hospital, Amritsar. The study was conducted after taking approval from institutional ethical committee. The study group included 25 patients clinically diagnosed as patients of polycystic ovary disease, attending OPD, Govt. Medical College and Hospital, Amritsar, between age group 14-35 years. 25 age and sex matched normal healthy volunteers were included as control. All patients were enrolled after taking written informed consent from patients or their relatives in their vernacular language. The study was conducted from November 2024 to April 2025.

Inclusion criteria

Women of age between 14-35 years, clinically diagnosed patients of PMOS.

Exclusion criteria

Women of age less than 14 years and more than 35 years, Women who didn't give consent, Patients of thyroid dysfunction, Cushing syndrome. Patients taking treatment for diabetes, hypertension, obesity, pelvic inflammatory disease and hyperprolactinemia.

A questionnaire was prepared to collect the general information like age, lifestyle history, family history of PMOS, dietary history, menstruation history, marital status, sleep disturbances and reproductive issues (if any) from both the control group and clinically diagnosed cases of PMOS. Anthropometrical data were collected in terms of height, body weight and BMI {Height in cm (bare foot, standing erect against wall), weight in kg (in a weighting scale, bare foot, light clothing}, finally the clinical examination of the participants was carried out which includes the general appearance, hair quality, facial hair, facial skin and body hair, acanthosis nigricans, acne was observed.

The patients and control group were investigated for Fasting Plasma Glucose, Serum FSH (Follicular stimulating hormone), Serum LH (Luteinizing hormone), Serum Prolactin, Serum TSH, Serum total Testosterone, Serum Insulin and C-peptide, HOMA-IR was calculated.[7-13]

Sample for these parameters was collected on 5th day of cycle. The data gathered was analysed using student t test to study the variance amongst two groups $p<0.05$ was considered statistically significant.

RESULTS

This study included 25 clinically diagnosed cases of PMOS along with age matched individuals without PMOS served as controls. All the participants i.e. individuals with and without PMOS were evaluated for serum FSH, serum LH, serum TSH and serum Prolactin, serum total Testosterone, Serum Insulin, C-peptide, Fasting plasma Glucose and glycosylated Haemoglobin. They were subjected to a questionnaire regarding the family history, lifestyle history, menstruation history, reproductive issues, weight gain history, sleep disturbances along with anthropometric measurements which included BMI and waist hip ratio (Table 1).

Table 1: The demographic details, lifestyle and clinical characteristics of the individuals with PMOS.

Parameters			
BMI	Overweight (60%)	Obese (35%)	Underweight (5%)
Lifestyle	Sedentary (84%)	Active (16%)	
Diet	Vegetarian (n=13) (52%)	Non vegetarian (n=11) (44%)	Lactose intolerance (n=1) (4%)
Menstrual status	Oligomenorrhea (72%)	Primary amenorrhea (12%)	Secondary amenorrhea (16%)
Family History	Present (22%)	Absent (78%)	
Skin patches	Positive (50%)	Negative (50%)	
Hair thinning	Positive (92%)	Negative (8%)	
Acne issues	Positive (55%)	Negative (45%)	
Hirsutism	Positive (82%)	Negative (18%)	
Pre-Diabetic	Positive (58%)	Negative (42%)	
Insulin Resistant	Positive (65%)	Negative (35%)	
Sleep disturbances	Positive (75%)	Negative (25%)	
Mood swings	Positive (65%)	Negative (35%)	
Fatigue	Positive (75%)	Negative (25%)	

Demographic details, lifestyle and clinical characteristics of the patients given in Table 1 indicate that sedentary lifestyle had a positive impact on individuals with PMOS. All the overweight individuals had insulin resistance. As per the Standard Consensus Statement of body mass index (BMI) for Indian population, patients were grouped as normal weight (BMI=18.0-22.9), overweight (BMI=23.0-24.9) and obese (BMI≥ 25). In our study, the majority of the patients were overweight (60%) and obese (35%), respectively, though a small portion was underweighted (5%).

All the individuals with and without PMOS were evaluated for various hormones, it was observed that the levels of Luteinising Hormone (LH), Prolactin, Testosterone were increased significantly in individuals having PMOS whereas changes in TSH were not statistically significant or were within ICMR normal range. The mean FSH was significantly lower in the study group as compared controls ($p<0.05$). Levels of Insulin and C-peptide though raised in individuals with PMOS did not attain statistical significance (Table 2).

To further evaluate these individuals were sub divided into groups based on the levels of TSH as sub-clinical, normal, hypothyroid and hyper thyroid state. It was observed that 12 individuals had sub-clinical hypothyroidism and 13 had normal thyroid status. None of the individuals had hypo or hyper thyroid status.

Table 2: Depicting mean values of serum LH, serum FSH, serum prolactin, serum total testosterone, serum TSH, insulin and c-peptide in study and control groups.

Parameters (Normal range)	Study Group Mean±SD	Control Group Mean±SD	P value
Serum LH (2.75-20.68 mIU/ml)	13.43±6.781	3.85 ±2.25	<0.05
Serum FSH (2.59-15.12 mIU/ml)	4.623±1.725	6.15 ±1.1	<0.05
Serum Prolactin (5.13-37.35 ng/ml)	18.61±5.057	10 ±4.13	<0.05
Serum Total Testosterone (0.06- 0.68 ng/ml)	0.85±0.3	0.44±0.15	<0.05
Serum TSH (0.52-4.16µIU/l)	2.8±1.2	2.6±1.0	NS
Serum Insulin (1.9-39.72 µIU/ml)	15.2±8.4	7.5±3.2	<0.05
C-peptide (0.5-2.0 ng/ml)	2.8±1.1	1.5±0.6	<0.05

NS- Not significant

Table 3: Levels of different hormones in individuals depending on the levels of TSH.

Parameter	Individuals with Sub-clinical Hypothyroidism Mean ±S.D.	Individuals with overt Hypothyroidism Mean ±S.D.	P value
TSH (mIu/l)	8.72±0.60	18.17±1.2	<0.001
FPG (mg/dl)	95±8.60	98.3±40.8	NS
Insulin (µIU/ml)	16.8±7.5	21.2±1.5	NS
C-peptide (ng/ml)	3.0±0.9	3.6±0.4	NS
FSH (mIU/ml)	4.5±1.5	3.4± 0.8	<0.05
LH (mIu/ml)	14.5± 5.8	17.8±4.5	NS
Prolactin (ng/ml)	28.5±5.2	52±3.8	<0.05
Testosterone (ng/ml)	.055± 0.34	1.05±0.30	<0.05
HOMA-IR	2.52	3.0	NS

NS- Not significant

Among the hormonal parameters compared between PMOS patients with sub clinical hypothyroidism and overt hypothyrodism, statistcally significant differences were observed in TSH, FSH, Prolactin and total Testosterone. FSH was significantly lower in overt Hypothyrodism group, whereas Prolactin and Testosterone were Significantly higher. In contract LH, FPG, Insulin and C-peptide did not show statistically significant difference between these two groups.

The study group was further divided into 3 groups according to age. Group 1 depicted women of age group 14-19 years, group 2 had women of age group 20-27 years and group 3 had women of age group 28-35 years. They were asked about their conception difficulty. It is observed that women of group 2 and group 3 have difficulty in conceiving a child i,e 76% women of reproductive age group with PMOS has difficulty in conceiving a child.

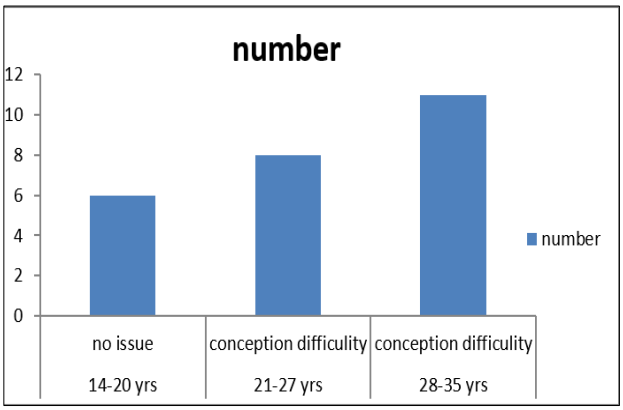

Figure 1: The conception chances in study group.

DISCUSSION

The present data shows that; the mean serum LH level is higher in PMOS patients as compared to controls. Ventiroli S et al observed high mean serum LH values in PMOS patients at day 5-6 of menses.[14] The mean serum FSH levels in the present study are lower than the controls. Holte J et al found lower FSH levels in women with PMOS than during the early follicular phase of normally ovulating women, suggesting a role in anovulation in PMOS.[15] In the present study mean serum total testosterone levels are high in study group as compared to control group and it is positively and significantly correlated with LH, FSH. The correlation between testosterone and LH is highly significant, because testosterone opposes the inhibitory feedback action of oestrogen on the release of gonadotropins. In PMOS women LH is positively correlated with testosterone. Solorzano et al had proved that in women hyperandrogenism alters the inhibition of the Gonadotropin releasing hormone (GnRH) pulse generator, leading to high LH production.[16] In both PMOS patients and control groups mean Prolactin levels were within normal range. Lower mean Prolactin was significantly higher in study group as compared to control group ($p<0.05$). The mean serum TSH levels in the present study are within normal range so TSH shows no correlation with any parameters.

PMOS patients with overt hypothyroidism showed significantly higher Prolactin and Testosterone and lower FSH vs sub clinical hypothyroidism ($p<0.05$), while LH, FPG, Insulin and C-peptide remain non-significant. We asked them about the family history of PMOS (if any), only 22% of women in study group told that there was someone in their family and/or relatives who suffered from PMOS prior to them and 78% of women did not have any family history of PMOS, so family history is not significant in predisposition of PMOS cases. We also asked them about their lifestyle and among 25 women of study group 21 women (84%) women had sedentary lifestyle which means sedentary lifestyle predisposes to PMOS. We also enquired about their dietary habits and 13 women were vegetarians, 11 women were non vegetarians, and 1 woman was lactose intolerant so from this we can conclude that diet has no significant role in causation of PMOS.[17,18] We also asked about their menstrual periods. All women were suffering from menstrual irregularities either amenorrhea or oligomenorrhea or polymenorrhea. In this study, 18 (72 %) of the patients had

oligomenorrhea, 2 (12%) had primary amenorrhea, 3 (16%) had secondary amenorrhea, and 2 (8%) had polymenorrhea. These findings are similar to a study done by Kamrul et al.[19]

On physical examination we noticed 23 women (92%) out of 25 women had oily skin, acne and hair fall and only 50% women had skin patches. Insulin resistance was present in 65% of women. Insulin and LH act synergistically, they stimulate tyrosine phosphorylation of Insulin receptor substrate -1 (IRS1) and increased Glycogen synthetase kinase 3β (GSK-3β) in adipose tissue which causes insulin resistance through IRS-serine phosphorylation. Decreased expression of insulin regulated glucose transporter GLUT-4 in PMOS adipocytes is also seen.[20] Androgen may interfere with insulin signalling by amplifying phosphorylation of Akt mammalian target ribosomal S6 Kinase and increasing serine 636/639 phosphorylation of IRS-1.[21]

Hirsutism is referred to as excessive unwanted hair growth on the female body, characteristically similar as male body due to the higher production of androgens in the female body. In this study hirsutism is also present in 82% cases. The presence of excessive male hormones in the female body leads to the development of masculine characteristics like uncontrolled growth of terminal hair throughout the body especially the face, areola, and genitals, proved by Armanini et al.[22] The other symptoms present were sleep disturbances, fatigue and mood swings. So, from this study it is cleared that PMOS cause reproductive hormonal imbalance which results in acne, oily skin, hirsutism, hair fall, obesity, insulin resistance, menstrual irregularities, difficulty in conception, fatigue. Thus, this syndrome not only affects physical health but also spoils the quality of health by disturbing sleep and mental health. So, the patients are more likely to face the issues of mood swings due to continuous and frequent hormonal changes in the body, also as studied by Zehravi et al.[23]

Limitations

This study has some shortcoming such as this study has small sample size. The pathogenesis of PCOS is still unclear. The testing is costly. It is difficult to follow up the patients of PCOS for long term. It is also difficult to prove whether cardiovascular disease i.e. heart disease, stroke are due to PCOS or some secondary underlying cause.

CONCLUSION

Hormonal profile testing is an important tool to know the basic pathogenesis of PMOS. It helps in taking decision regarding treatment modalities required for better outcome and it can also be used for differential diagnosis. In addition to clinical prognosis, it may help in the assessment of efficacy of therapy. Lifestyle modifications, including a balanced diet and regular exercise, play an important role in weight management and insulin sensitivity. Sedentary lifestyle and fast food with less physical activities predisposes to PMOS. Healthy lifestyle i.e. healthy diet (diet low in carbohydrates) and regular exercise is important in PMOS patients because this can help to regulate blood sugar levels, reduces body weight and abdominal fat, which in turn reduces androgens and improves body and facial hair growth, and it also improves insulin resistance. Effect of lifestyle modifications i.e. alteration of diet intake and exercise therapy to treat obese women with PMOS were successfully employed by Hoeger et al and Giallauria et al. Early intervention and continuous monitoring are crucial for decreasing long-term health risks. Further research on PMOS in diverse populations is recommended for a more nuanced understanding and tailored interventions.

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