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Original Research Article

The Comparison of Cardiac Autonomic Functions in Patients with Polycystic Ovarian Syndrome and Healthy Controls

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Abstract

Introduction: Polycystic ovarian syndrome (PCOS) is a prevalent heterogeneous endocrine condition that affects 5-10% of women of reproductive age. It is one of the most prevalent reasons for female infertility. Autonomic function testing (AFT) is a non-invasive technique used to assess cardiac autonomic dysfunction. AFT might assist us in identifying PCOS women who are more likely to suffer cardiovascular issues.

Aim and Objectives: To evaluate and compare cardiac autonomic function tests in polycystic ovarian syndrome patients and age-matched healthy women.

Material and Methods: 60 women between the ages of 18 and 35 were recruited for this research. The research group was divided into two groups. Women with PCOS who had a BMI of 23 were classified cases (n = 30), while healthy women with the same BMI were labelled controls (n = 30). They were tested for autonomic function.

Results: When compared to healthy controls, women with PCOS had an autonomic imbalance with higher sympathetic discharge ($p < 0.05$). When compared to healthy controls, there was less vagal drive.

Conclusion: Autonomic dysfunction was seen in women with PCOS, with increased resting sympathetic and reduced parasympathetic activity.

Keywords: Polycystic Ovarian Syndrome (PCOS), Autonomic Function Tests (AFTS), Body Mass Index (BMI), and Autonomic Dysfunction.

Introduction

Polycystic ovarian syndrome (PCOS) is a prevalent endocrine and developing lifestyle condition affecting women of reproductive age. This is a prevalent cause of female infertility.[1] The Stein Leventhal syndrome was named after Irving Stein and Michael Leventhal, who published the first comprehensive study on PCOS in 1935 [2].

According to the World Health Organization (WHO), around 116 million women worldwide suffer with PCOS in 2012. [3] The prevalence of PCOS varies greatly depending on the diagnostic criteria employed, ranging from 2.2% to 26%. [4].

The actual pathophysiology of PCOS is intricate and unknown, however genetic and environmental variables may play a significant role in PCOS etiopathogenesis. Other variables that may contribute to PCOS include obesity and hypothalamic-pituitary-ovarian (HPO) axis dysfunction. [5] Hyperandrogenism and insulin

resistance are also factors in the pathophysiology of PCOS. Around 60% to 80% of PCOS patients have hyperandrogenism. Insulin resistance has also been observed in 50% to 80% of PCOS women [6].

Menstrual abnormalities (Anovulation or oligo-ovulation), hyperandrogenism-related characteristics such as hirsutism, acne, or male pattern alopecia, and infertility are all symptoms of PCOS. [7] Hirsutism, acne, obesity, and other physical characteristics contribute to psychological suffering in PCOS. [8]

Many of our bodily activities are controlled by the autonomic nervous system. In healthy people, the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS) are in balance, which is known as the sympathovagal balance, and it contributes to active internal homeostasis. [9] PCOS-related factors are also associated with increased sympathetic activity. [10] Obesity, insulin resistance, and chronic stress can all promote autonomic dysfunction, resulting in increased sympathetic drive and decreased vagal activity.[11] Our goal is to identify autonomic dysfunction in PCOS women and compare it to healthy age matched controls. There have been several research comparing sympathetic and parasympathetic reactivity tests in PCOS women, however there have been relatively few investigations in the Indian community.

Materials and Methods

The individuals were recruited from the Gyanecology O.P.D., Mahila Chikitsalya, Jaipur, after our study protocol was authorised by the Institutional Ethics Committee. All individuals were informed about the testing procedures, and their free written agreement was obtained.

Study Design

It was a cross-sectional comparative research carried out at the Department of Physiology, S.M.S. Medical College, and the affiliated hospitals. 30 PCOS patients (BMI ≥ 23) and 30 age-matched healthy females (BMI ≥ 23) participated in the study.

Inclusion criteria

For case group:

1. PCOS patients (BMI ≥ 23)
2. Between the ages of 18 and 35.
3. Subjects providing written informed consent.

For control group:

1. Healthy females (BMI ≥ 23) with a normal menstrual cycle and no clinical hyperandrogenism characteristics.
2. Between the ages of 18 and 35.
3. Cooperative subjects who provide informed written permission.

Exclusion criteria (for both groups)

1. Women who are pregnant or nursing.
2. Women using any form of medicine, such as hormonal contraception.
3. Subjects that refused to cooperate.

Rotterdam criteria were used as the foundation for choosing PCOS patients [13]. PCOS can be diagnosed in any woman who exhibits at least two of the following three symptoms, per the criteria:

1. Anovulation or oligo-ovulation.
2. Biochemical or clinical hyperandrogenism
3. The presence of polycystic ovaries.

The Procedure

Following obtaining informed consent from all registered subjects, a full history was obtained from each participant, including personal characteristics such as name, age, residence, and phone number, as well as menstrual history and any abnormalities (Amenorrhoea/ Oligo menorrhoea/ menorrhagia). Participants were told to refrain from coffee and other stimulant-containing goods, alcoholic beverages, and strenuous exercise for 24 hours before to the test. During 20 minutes, subjects sat

peacefully in the supine posture in a silent and dark environment. The resting heart rate (HR) was measured after 5 minutes of supine repose. The mercury sphygmomanometer was also used to monitor resting Systolic blood pressure (SBP) and diastolic blood pressure (DBP). Participants will undergo a battery of autonomic function tests that will look at the variability of heart rate at rest as well as its response to typical physiologic stimuli via various manoeuvres. Several endogenous and environmental variables can interfere with autonomic testing and must be managed.

Autonomic function tests

The Cardiac Autonomic Neuropathy Analysis System (CAN Win) version 1.0 with interpretation will be used to perform all non-invasive autonomic function testing [14].

Evaluation of parasympathetic nervous system functions: -

1. Heart Rate at Rest (beats per minutes)
2. The initial heart rate reaction to standing, often known as the 30:15 ratio.
3. Response of the heart rate to the deep breathing test (Expiration/Inspiration ratio, or E: I Ratio).
4. The Valsalva ratio

Sympathetic nervous system function evaluation:

1. Standing blood pressure response (LST).
2. The isometric handgrip test blood pressure response (IHG).
3. The reaction of blood pressure to the cold pressor test (CPT).

Statistical Analyses

SPSS version 21 was used for statistical analysis. The arithmetic data were reported in terms of the Mean standard deviation. The Unpaired 't'-test was used to compare all parameters. p values more than 0.05 were regarded non-significant, p values less than 0.05 were considered statistically significant, and p 0.001 was considered extremely significant.

Results

It was a cross-sectional comparative observational study involving 30 PCOS patients and 30 healthy controls. The mean and standard deviation of all data values were calculated.

Comparison of Anthropometric parameters

The mean ages of PCOS and control participants were 25.13 ± 4.76 and 24.13 ± 4.66 years old, respectively. PCOS patients weighed substantially more than controls (78.8 ± 5.82 and 63.53 ± 5.96 cm, respectively, p = 0.001).

BMI was also considerably higher in comparison to controls (31.82 ± 1.93 and 25.74 ± 2.01, p = 0.002). There was no statistically significant difference in height or age between the groups. (Table 1)

Table 1: Baseline anthropometric characteristics of PCOS patients and controls.

Anthropometric parameters	PCOS cases (n = 30)	Controls (n = 30)	p value
Age	25.13 ± 4.76	24.13 ± 4.66	0.414 (NS)
Height	1.56 ± 0.07	1.57 ± 0.04	0.223 (NS)
Weight	78.8 ± 5.82	63.53 ± 5.96	0.001(S)
B.M.I.	31.82 ± 1.93	25.74 ± 2.01	0.002 (S)

(p value < 0.05) – Significant (S), Non - significant (NS)

Comparison of Autonomic function test parameters: In this investigation, autonomic function tests were performed on all PCOS patients and healthy controls (Table 2). When PCOS patients were compared to controls, their resting heart

rate and SBP were considerably higher. While comparing resting DBP, no significant change was discovered.

PCOS patients reported a considerably higher decrease in SBP when standing and a significantly higher rise in DBP while performing CPT and Isometric hand grip exercise. Moreover, the 30:15 ratio, E:I ratio, and Valsalva ratio were all considerably lower in PCOS individuals (FIG. 1)

Table 2: Comparison of Autonomic function tests (AFT) parameters between PCOS patients and controls

AFT parameters	PCOS cases (n =30)	Controls (n = 30)	p value
Resting heart rate (bpm)	80.43 ± 4.45	75.3 ± 2.83	< 0.001 (HS)
E:I ratio	1.13 ± 0.07	1.29 ± 0.07	0.005 (S)
30:15 ratio	0.97 ± 0.05	1.12 ± 0.07	<0.001 (HS)
Valsalva ratio	1.12 ± 0.06	1.57 ± 0.24	< 0.001 (HS)
Resting Systolic BP (mm of Hg)	117.53 ± 5.32	111.27 ± 7.6	0.0003 (S)
Resting Diastolic BP (mm of Hg)	75.47± 6.93	72.87 ± 7.09	0.078 (NS)
Fall in Systolic BP with change in posture (mm of Hg)	17.53 ± 2.14	7.47 ± 1.17	< 0.001 (HS)
An increase in Diastolic BP after isometric handgrip test (mm of Hg)	9.13 ± 1.25	16.8 ± 1.45	0.008 (S)

S : significant (p value < 0.05) , NS : Non-significant , HS : Highly significant (p value <0.001)

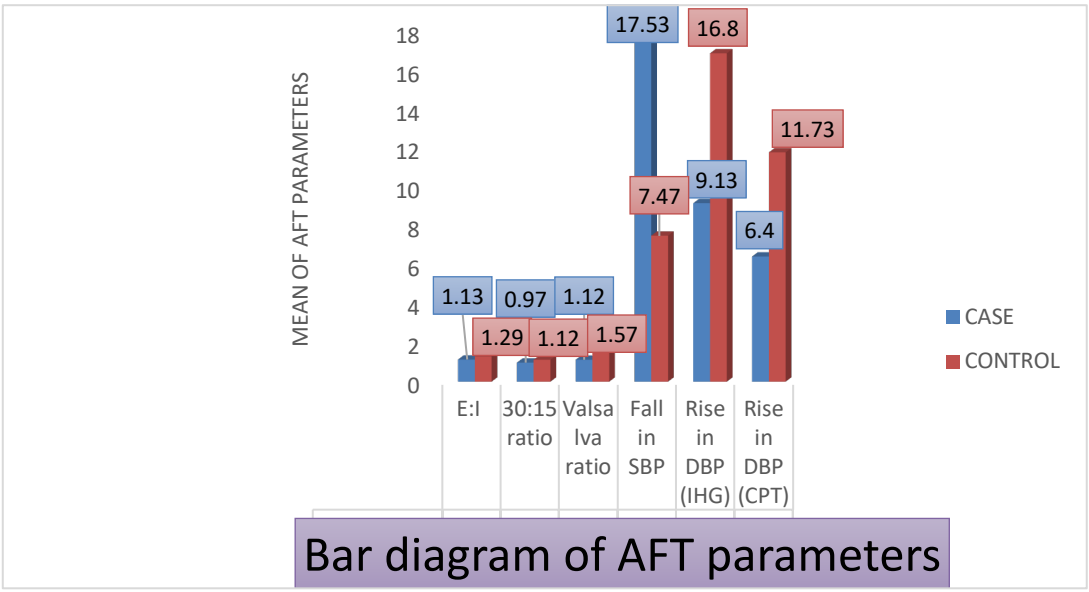

Figure 1

Discussion

The current study included 60 subjects: 30 PCOS patients and 30 healthy controls (age matched) from the Sawai Man Singh medical college and its affiliated institutions. The study's goal is to measure and evaluate cardiac autonomic function tests in PCOS patients and compare them to healthy controls.

Apart from a general weight gain (Table 1), PCOS women exhibited an android kind of obesity. [15]. Obesity is thought to produce autonomic dysfunction in the form of diminished vagal activity and increased adrenergic activity. [16]. This was supported further by the results of autonomic function testing, which revealed a decrease in vagal activity and an increase in sympathetic activity. (Table 2).

Many studies have found a link between PCOS and autonomic function tests (AFTs). Because resting heart rate is primarily controlled by vagal discharge, people with PCOS may have reduced vagal tone, resulting in an altered sympathovagal balance during rest.

Saranya et al 2014 [17] discovered a substantially elevated 30:15 ratio and a lower E:I ratio in PCOS patients as compared to healthy controls in a research to test cardiovascular autonomic systems. In his study, he also discovered a decrease in SBP with a change in posture, as well as an increase in DBP during IHG.

Our findings contradict his findings, indicating that sympathetic discharge increases gradually in PCOS patients.

Akhter et al 2019 [18] investigated the link between parasympathetic reactivity and oxidative stress in PCOS and discovered a lower E:I ratio, 30:15 ratio, and Valsalva ratio.

Our findings supported his findings that PCOS individuals have greater basal sympathetic discharge.

Iqbal et al 2021 [19] found similar results, with PCOS patients having a lower 30:15 ratio than healthy controls.

Sukhera et al 2022 [20] investigated parasympathetic reactivity in PCOS patients and discovered reduced E:I and Valsalva ratios, as well as an increased 30:15 ratio, indicating lower vagal activity in PCOS patients.

Our findings indicate a shift in sympathovagal balance towards the sympathetic system. As a result, women with PCOS may have compromised sympathovagal balance.

Our small sample size is one of the study's weaknesses. Larger sample size investigations are required to confirm our findings and generalise them to the broader population. Future research can assess hormones such as catecholamines and sex steroids for improved prognosis and result.

Conclusion

The current investigation found that obese women with PCOS had autonomic dysfunction, with sympathetic predominance and parasympathetic withdrawal. As a result, PCOS sufferers are thought to be at a higher risk of acquiring cardiovascular issues. As a result, this study emphasises the relevance of non-invasive screening technologies such as AFTs in PCOS patients.

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References

1. Azziz R. Controversy in clinical endocrinology: diagnosis of polycystic ovary syndrome: the Rotterdam criteria are premature. J Clin Endocrinol Metab. 2006; 91:781–785.
2. Stein IF, Leventhal M. Amenorrhoea associated with bilateral polycystic ovaries. Am J Obstet Gynecol. 1935; 29:181–191.
3. National institute health. Evidence – based Methodology Workshop on Polycystic Ovary Syndrome. December 3-5, 2012.
4. March WA, Moore VM, Willson KJ, Phillips DI, Norman RJ, Davies MJ. The prevalence of polycystic ovary syndrome in a community sample assessed under contrasting diagnostic

criteria. Hum Reprod. 2010; 25:544–51.
5. Doi SA, Al-Zaid M, Towers PA, Scott CJ, Al-Shoumer KA: Ovarian steroids modulate neuroendocrine dysfunction in polycystic ovary syndrome. J Endocrinol Invest. 2005; 28:882-892.
6. Legro RS, Castracane VD, Kauffman RP: Detecting insulin resistance in polycystic ovary syndrome: purposes and pitfalls. Obstet Gynecol Surv. 2004; 59:141-154.
7. Dc dutta's textbook of gynecology
8. Kitzinger C and Willmott J. The thief of womanhood. women's experience of polycystic ovarian syndrome. Soc Sci Med. 2002; 54:349–361.
9. Pal GK. Sympathetic and Parasympathetic Systems. In: Textbook of Medical Physiology. Ahuja Publications, New Delhi. 2010; 2009-216.
10. Fagius J. Sympathetic nerve activity in metabolic control--some basic concepts. Acta Physiologica Scandinavica. 2003; 177:337–343.
11. Seals DR, Bell C. Chronic sympathetic activation: consequence and cause of age-associated obesity? Diabetes. 2004; 53:276-84.
12. Pattnaik S, Gupta S, Saxena U, Matlani M, Kapoor R. Comparison of autonomic function tests and high-sensitivity C-reactivity protein in overweight patients of polycystic ovarian syndrome and overweight controls. Indian J Physiol Pharmacol. 2020;64(4):303-8.
13. Franks S. Controversy in clinical endocrinology: diagnosis of polycystic ovarian syndrome: in defence of the Rotterdam criteria. J Clin Endocrinol Metab. 2006; 91:786-9.
14. Zygmunt A, Stanczyk J. Methods of evaluation of autonomic nervous system function. Arch Med Sci. 2010.
15. Pasquali R, Casimirri F. The impact of obesity on hyperandrogenism and polycystic ovary syndrome in premenopausal women. Clin Endocrinol. 1993; 39: 1– 16.
16. Chen GY, Hsiao TJ, Lo HM, Kuo CD. Abdominal obesity is associated with autonomic nervous derangement in healthy Asian obese subjects. Clin Nutr. 2008 Apr;27(2):212-7.
17. Saranya K, Pal GK, Habeebullah S, Pal P. Assessment of cardiovascular autonomic function in patients with polycystic ovary syndrome. J Obstet Gynaecol Res. 2014 Jan;40(1):192-9.
18. Akhter A., Ferdousi S., Sultana S., & Mostafa M. Relationship between parasympathetic reactivity and oxidative stress in Polycystic ovary syndrome. Journal of Bangladesh Society of Physiologist, 2020; 14(2): 48–55.
19. Iqbal G., Ganai J., Khan N., Anwar A., & Iqbal R. Evaluation of Autonomic Function in Polycystic Ovary Syndrome with Hypothyroidism. International Journal of Clinical and Experimental Physiology, 2021; 8(2): 82-87.
20. Sukhera S, Ilyas J, Iqbal S, Mastoor M, Zaman Q. Parasympathetic Reactivity and Oxidative Stress among Participants Suffering from the polycystic ovarian syndrome. Pakistan Journal of Medical & Health Sciences. 2022 Jul 23;16(05):1126.