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Evaluation of resting heart rate in women with polycystic ovary syndrome: A cross sectional study

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Abstract
Background: Polycystic ovary syndrome (PCOS) is a frequent endocrine disorder in the female population during the reproductive years. PCOS symptoms include irregular menstrual cycles, infertility, hirsutism, acne and obesity. In addition, this syndrome is frequently associated with classic cardiovascular risk factors such as insulin resistance, dyslipidemia, type 2 diabetes, hypertension, central obesity, metabolic syndrome and elevated serum levels of C-reactive protein. By studying HR at rest, indirect information on the integrity of cardiac autonomic modulation can be obtained at lower cost.
Method: Total 70 subjects were approached among them 10 were excluded according to exclusion criteria. The study included total 60 women in which they were divided into 2 groups; Group A and Group B; according the Rotterdam's criteria for inclusion of PCOS. 30 women with PCOS were in Group A and another 30 regular menstruating women were in Group B. RHR was measured in both the groups.
Results: The results showed that there was a statistical significant difference of RHR between two groups. Women with PCOS tends to have higher heart rate than controls, this finding supports the presence of cardiovascular autonomic dysfunction in PCOS.
Conclusion: PCOS might have cardiovascular dysfunction and associated with adverse cardiac events in later stage of life. Higher resting heart rate can be counted as cardiovascular disease risk factors for PCOS.

Keywords: polycystic ovary syndrome, resting heart rate, cardiac dysfunction

Introduction

Polycystic ovary syndrome (PCOS) is a frequent endocrine disorder in the female population during the reproductive years, with a prevalence ranging from 5 to 10%. PCOS symptoms include irregular menstrual cycles, infertility, hirsutism, acne and obesity. In addition, this syndrome is frequently associated with classic cardiovascular risk factors such as insulin resistance, dyslipidemia, type 2 diabetes, hypertension, central obesity, metabolic syndrome and elevated serum levels of C-reactive protein [1]. PCOS patient have an estimated 4-11 fold increased risk for coronary artery disease [2] higher prevalence of diabetes (40%) and as well as hypertension (60%) [3]. The abnormalities include decreased cardiac systolic flow velocity [4], diastolic dysfunction [5], increased vascular stiffness [6], endothelial dysfunction [7], low grade chronic inflammation [8], increased homo-cysteine [9], impaired fibrinolysis [10] and increased tissue plasminogen activator antigen [11].
By studying HR at rest (RHR), indirect information on the integrity of cardiac autonomic modulation can be obtained at lower cost. The results of studies on the relationship between HRV (heart rate variability) and hormonal female physiology are contradictory, with a significant age-dependent effect [1].
There is increasing evidence that patients with polycystic ovary syndrome (PCOS) have increased cardiovascular risk compared with age matched controls. It has been estimated that myocardial infarction is seven times more likely in patients with PCOS and cardiac catheterization studies have shown more extensive coronary artery disease in these patients than in women with normal ovaries. Furthermore, significant subclinical carotid atherosclerosis has been demonstrated on carotid artery ultrasound in women with PCOS [12].
The effects of menstrual cycle and hormone re-placement therapy (HRT) on HRV have previously been investigated with contradictory results. To the best of our knowledge, no data are available on the characteristics HR parameters in PCOS patients. Therefore, we aimed to investigate the characteristics of cardiac autonomic innervations with HR in PCOS patients and compare with healthy controls [13].

Material and Methodology

In a cross-sectional study, 60 female age group of 20 to 40 years were included in the study. Inclusion criteria were (Rotterdam criteria for polycystic ovarian syndrome [14]) 1). Age group: - 20 to 40 Years 2).Menstrual irregularities (> 9 cycles/year OR > 35 days between cycles) 3).Polycystic Ovaries on Ultrasonography (> 12 antral follicles in one ovary and / or ovarian volume > 10 cm^2) 4). Oligo / Anovulation 5). Clinical and / or Biochemical signs of Hyperandrogenism 6). Hirsutism

Exclusion Criteria: 1). Hypertension 2). Diabetes Mellitus 3). Hypercholesterolemia 4). Hysterectomy 5). Menopause 6). Antidepressant drugs

Procedure

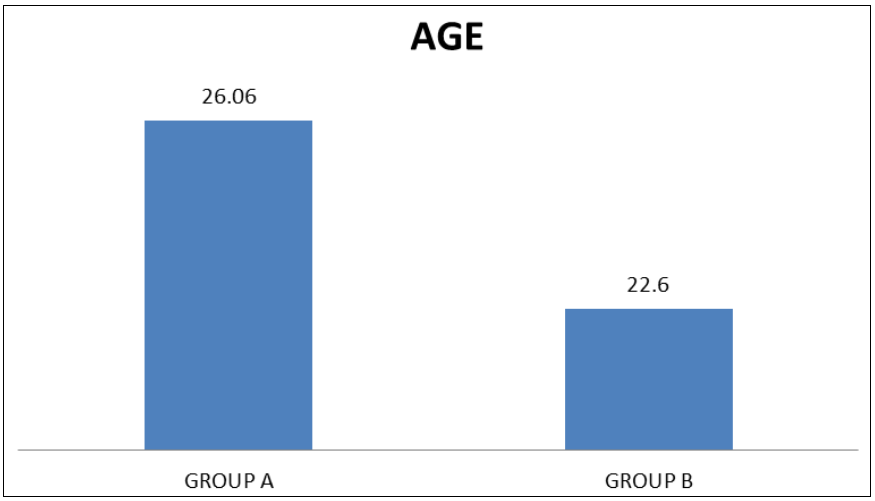
Ethical clearance was obtained from the institutional ethical committee. Data selected from the different gynecology hospital, infertility clinics and multispecialty hospital who have diagnosed PCOS. Every subjects were approached individually for the study purpose and objective of the study was explained to them. Written consent form had been taken from every subjects prior to the study. Total 70 subjects were approached among them 10 were excluded according to exclusion criteria. 60 subjects had divided into two groups, Group A and Group B. Group A includes diagnosed women with PCOS. Group B Includes regular menstruating women. RHR was measured in both the groups using the radial pulse.

Result

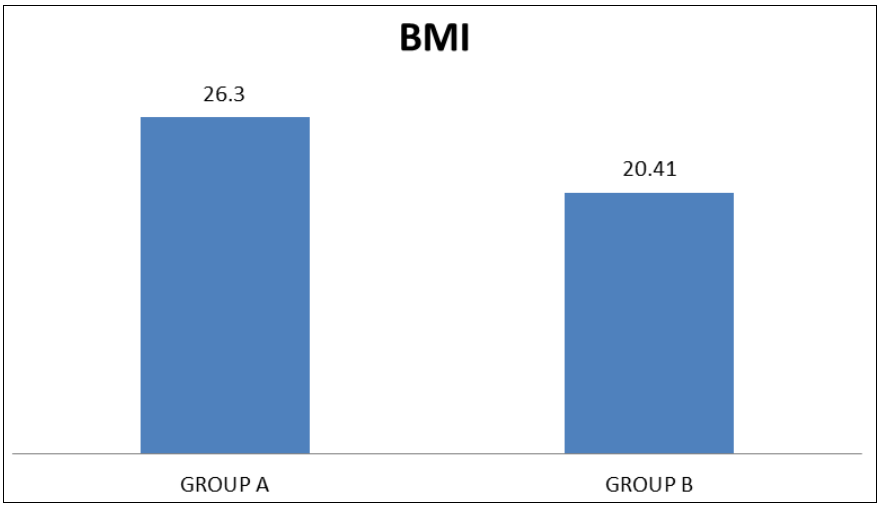
Statistical analysis was done by using SPSS version 26. Confidence interval was kept at 95% and level of significance was kept at 0.05. Non-parametric test was used to analyze the data as the data was not normally distributed. Kolmogorov-smirnov test and Shapiro-will tests were applied to check whether the data follows normal distribution or not. Statistically significant difference was found between groups ($p<0.05$), which suggest that the data did not follow normal distribution.

Table 1: Descriptive statistics of groups

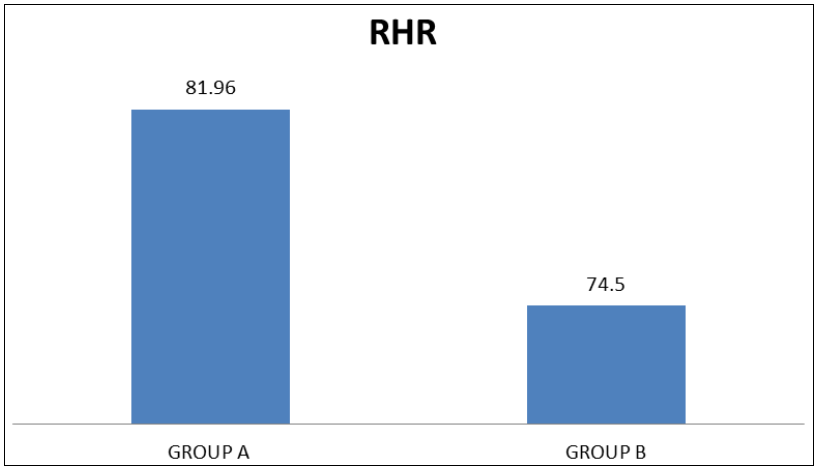
Parameters	Group A (MEAN±SD)	Group B (MEAN±SD)
Age	26.06±4.1	22.6±3.01
Height	160.15±4.18	155.43±5.36
Weight	62.09±16.85	49.45±8.41
BMI	26.3±5.02583	20.41±3.10



Graph 1: Mean Age of Both Groups



Graph 2: Mean BMI of both groups



Graph 3: Mean RHR of both groups

Table 2: Between group analysis by Man Whitney U Test

RHR	MEAN	SD	p-value
GROUP A	81.9667	10.36	<0.001
GROUP B	74.5	3.04846	

Discussion

The present study was conducted to evaluate Resting Heart Rate in women with PCOS. This study was conducted on 60 participants, who were divided into two groups. Statistical analysis of RHR between groups was completed. The results showed that there was a statistical significant difference of RHR between two groups. Because RHR is mainly under vagal modulation, an increased RHR in these patients could be attributed to the reduced vagal activity. The raised SBP and DBP observed in patients with PCOS could be due to increased sympathetic drive as regulation of BP is mainly under sympathetic control [15]. Polycystic ovary syndrome has emerged as a syndrome in which various cardiovascular risk factors have been interlinked. PCOS is a common endocrine disorder associated with long-term health risks, including IR, diabetes mellitus, dyslipidemia, hypertension, and premature atherosclerosis [16].

A study conducted by Malathi Balamurugan (2015) on women diagnosed with PCOS showed that altered cardiac autonomic activity and unfavorable metabolic profile present in women with PCOS, which are the important risk factors for cardiovascular disease even in lean and ideal weight PCOS. The elevated resting HR and BP have also been recently proposed as independent cardiovascular autonomic function in PCOS [17, 18].

Oreo F *et al*. (2004) reported many differences between young women with PCOS and healthy one with respect to CVD risk factors and echocardiographic parameters. They have found that more arthogenic lipid profile, higher fasting glucose, higher LV mass and diastolic dysfunction in women with PCOS.

A significant association between resting HR and all-cause and cardiovascular mortality has been reported in numerous epidemiologic studies over the last 25 years [19, 20] and pertains in both the general population and in those with various cardiovascular diseases, including hypertension, acute myocardial infarction (AMI), and heart failure or left ventricular dysfunction [21]. Women with PCOS tends to have higher heart rate and blood pressure than controls, these findings supports the presence of cardiovascular autonomic dysfunction in PCOS due to manifesting as increased sympathetic nerve activity and decreased parasympathetic and overall cardiac modulation [22]. The control of heart rate depends on the interaction between the sympathetic and parasympathetic branches of the autonomic nervous system. There are several methods by which the autonomic modulation of the cardiovascular system can be assessed. RHR measurement is non-invasive and easy method to evaluate cardiac functions.

Higher resting heart rate was independently associated with increased risks of all-cause and cardiovascular mortality. This indicates that resting heart rate is a predictor of all-cause and cardiovascular mortality in the general population [23].One another meta-analysis by Fox (2008) based on large epidemiologic studies he concluded that increase in resting heart rate ratio is an independent predictor of cardiovascular and all cause mortality in men and women with and without diagnosed CVD.

The Framingham heart study carried out by Jennifer E ho (2014) included 4058 participants, found that individuals with higher heart rate are at elevated long term risk for cardiovascular events, in particular heart failure and all cause death. RHR in the present study has been fall between normal limit but still it is higher in PCOS participants group in comparison with normal participants.

Our finding supported by Agenieszka (2011) who conducted study on 34 obese and non-obese women with polycystic ovary syndrome. Study found that Heart rate and Blood pressure were higher in obese. PCOS group than compared normal weight PCOS individuals. Higher heart rate may be regarded as an early cardiovascular risk factor in obese adolescence girls with PCOS. Overweight and obesity have often been associated with PCOS. Studies have reported that more than 50% of these patients are either overweight or obese [24].

Obesity has long been known to cause derangement in autonomic functions in the form of increased adrenergic and decreased vagal modulation [25]. In the present study, Women with PCOS having more BMI value compared to normal individuals, this is suggesting that obesity is more prevalent in PCOS, parallel with the findings of the other study we have found that there is 50% of women found to be obese in PCOS group compared to normal group.

This suggesting that obesity is major cause for cardiovascular as well as metabolic disease in PCOS. Metabolic and cardiovascular disorders have been shown to be related with autonomic dysfunction [26, 27].

Furthermore studies reflected that resting heart rate is a risk factor of metabolic syndrome in adults as well as elevated resting heart rate is an independent risk factor for cardiovascular disease in healthy men and women [28].There is a need to conduct more studies in this area as PCOS common gynecological disorder occur during adulthood which affects health profile as well as cardiovascular risk factors should be taking in consideration while approaching this individuals.

Limitations of study

- HR is not widely used method to assess cardiovascular risk.
- Data cannot be generalized due to small sample size.
- Assessor error could be counted.

Future recommendations

- Other cardiovascular risks can be assessed
- Other HR measurement methods can be used

Conclusion

PCOS might have cardiovascular dysfunction and associated with adverse cardiac events in later stage of life. Higher resting heart rate can be counted as cardiovascular disease risk factors for PCOS. Therefore, early diagnosis of autonomic dysfunction are very important. Furthermore, Physiotherapy interventions such as aerobic exercise should be focused along with other medical attention in women with PCOS. Furthermore studies required to confirm relevance of this finding.

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