International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Udofia TA et al. Int J Reprod Contracept Obstet Gynecol. 2021 Jun;10(6):2437-2442
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20212189

Original Research Article

Clinical and sonographic features in infertile women with and without polycystic ovarian syndrome

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Received: 21 March 2021
Accepted: 27 April 2021

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ABSTRACT

Background: Polycystic ovarian syndrome (PCOS) is the most common endocrine cause of infertility affecting about 1 in 10 women of reproductive age. This study determined the proportion of infertile women with PCOS and compared clinical and sonographic features in infertile women with PCOS and without PCOS.
Methods: This was a prospective comparative cross-sectional study at the Lagos State University Teaching Hospital over a 6 month period. One hundred and fifty two infertile women were recruited and had trans-vaginal ultrasonography for the presence and absence of polycystic ovaries. The diagnosis of PCOS was made using the Rotterdam criteria with other relevant socio-demographic and clinical data noted in the study proforma. Student t and chi-square tests were used as appropriate.
Results: The prevalence of PCOS among infertile women was 32.9%. The mean age of infertile women diagnosed with PCOS and without PCOS was 33±4.90 and 32.71±5.00 years, respectively. Women with PCOS had significantly higher BMI than women without PCOS. Increased ovarian volume, peripheral follicular distribution and increased stromal echogenicity were observed in 60%, 74% and 94% of women with PCOS on trans-vaginal ultrasound compared to 11.8%, 2% and 2% of women without PCOS, respectively.
Conclusions: The prevalence of PCOS among infertile women is high. Clinical characteristics of women with PCOS and women without PCOS are similar except in their BMI and features that constitute the diagnostic criteria for PCOS.

Keywords: PCOS, Polycystic ovarian syndrome, Polycystic ovaries, Infertility, Rotterdam criteria

INTRODUCTION

Infertility is defined as the inability of a couple to achieve conception after one year of regular unprotected intercourse.[1] In Nigeria, it is one of the leading reasons for gynaecological consultation, with report estimates of two out of every five patients in gynaecological clinic presenting with infertility.[1] High premium is attached to child bearing in most African cultures such that women with infertility suffer from varying forms of social disapproval, marital disharmony, social rejection, psychological disorders and suicidal tendencies.[2] In tropical Africa, infertility rates range from 10-20%, while in the developed countries it is rated at 5-15%.[3]

PCOS is the most common gynaecological endocrine/metabolic disorder in women and commonest endocrine cause of infertility.[4,5] It occurs in 5-10% of

women of childbearing age.[4,5] Its exact cause is not known.[4] The Rotterdam 2003 criteria require at least presence of two of the following three conditions for the diagnosis of PCOS: oligo or anovulation (menstrual irregularity), clinical or biochemical signs of hyperandrogenism and polycystic ovaries on ultrasound.[6]

A comprehensive evaluation of both ovaries for assessment of polycystic ovaries, clinical manifestations of hyperandrogenism and establishment of menstrual disturbances is important in the diagnosis of PCOS.[6] This study assessed for these features in infertile women, determined the prevalence of PCOS and compared socio-demographic, clinical and sonographic features in women diagnosed with PCOS, using the revised Rotterdam 2003 criteria, with women without PCOS.

METHODS

This was a prospective comparative cross-sectional study between 1 January 2017 and 30 June 2017 in which 152 women being evaluated for infertility at the gynaecology clinic of the Lagos state university teaching hospital, Lagos were referred to the radiology unit for trans-vaginal ultrasonography. Consenting women aged 18-45 years with history of infertility were recruited while women with abnormal vaginal discharge, on ovulation induction medications, on-going vaginal bleeding, co-existing ovarian tumours and on chemo and/or radio-therapy were excluded from the study.

Each recruited participant completed a structured administered questionnaire to obtain socio-demographic and relevant clinical data. The anthropometric measurements, weight and height of each subject were taken using a calibrated weighing scale (Medfield equipment and Scientific limited, England) and a meter height scale (Avery company limited, England).

The study participants were examined in a well-lit changing room, to determine the distribution and density of terminal hair at 11 different body sites (lip, chin, chest, upper abdomen, lower abdomen, upper arm, forearm, thigh, lower leg, upper back and lower back), with each scored from 0-4 and the total score calculated.[7] Diagnosis of hirsutism was made if the total score was greater or equal to 8.[7]

Technique of trans-vaginal ultrasound

Each participant was asked to empty her urinary bladder and then taken into the examination room ensuring adequate privacy with a female chaperone in attendance. They were placed in a supine lithotomy position with both knees flexed on the examination couch with adequate exposure of the vulva. The examination area was sufficiently screened. All scans were performed in a systematic manner using the trans-vaginal 7.5 to 12 MHz broad band ultrasound curved-array transducer. A Mindray real time ultrasound scanner model Z5 was used. Folded sheets or pads were placed under the participant's buttocks to elevate her pelvis above the examination couch to allow room for transducers manipulation. Ultrasound coupling gel was applied into a latex male condom and used to completely cover the trans-vaginal probe. A different condom was used for each woman. After parting the labia, the probe covered with condom was then gently introduced into the participant's vagina advancing slowly toward the cervix. The transducer was then moved laterally to the adnexal area to properly visualize the ovaries. During the trans-vaginal ultrasound scanning, the ovaries could be brought into view by using one hand to compress the lower abdominal wall while the other hand manipulated the transducer. The trans-vaginal ultrasound image of the ovary in longitudinal plane appeared and was frozen for measurements. The ovaries were often identified by the presence of follicles, which appeared hypoechoic or anechoic. Once scanning was completed in the longitudinal plane, the probe was rotated 90 degrees counterclockwise so that the transducer was now in a transverse plane and frozen for measurements. After identification of the ovaries the size of the ovary was measured in three orthogonal planes, namely longitudinal (length) transverse (thickness) and anteroposterior (width). On measuring the dimensions, inherent volume software in the machine automatically calculated the volume. The measurements were obtained from the frozen ultrasound images with electronic calipers. The total number of follicles in each ovary was counted. Follicles were counted on the frozen images of two non-overlapping planes in the longitudinal section of each ovary and summed up together. Measurements of the follicles were made in their maximum internal diameters and recorded in mm, their distributions were also noted as either peripherally or randomly.

The diagnosis of polycystic ovary (PCO) morphology was made if 10 or more follicles each measuring 2-8 mm in diameter were present and peripherally arranged in the ovaries (giving a string of pearl appearance) and/or ovarian volume was increased greater than 10 ml.[8] A description of the distribution of the follicles was recorded by visual assessment of location of follicles as being scattered through the stroma or arranged peripherally in the classically described string of pearl at the margin of the ovary. Stromal echogenicity was defined as normal or increased (echogenic) in comparison to the myometrium whose echogenicity is greater than normal ovarian stroma.[8,9] To reduce intra observer variability, the measurements were taken thrice and an average obtained. After the procedure, the probe was withdrawn gently and slowly, patient was cleaned up with tissue paper and politely asked to stand up and dress up.

The Rotterdam 2003 criteria of at least the presence of two of the following three conditions oligo or anovulation (menstrual irregularity), clinical or biochemical signs of hyperandrogenism and polycystic ovaries on ultrasound,

was used to make a diagnosis of PCOS in this study. The hirsutism scores using the Ferriman/Gallwey scoring system, trans-vaginal sonographic ovarian findings (ovarian volume, follicular number, size, distribution and stromal echogenicity) for each woman were recorded in the study proforma for subsequent data analysis.

Statistical analysis

The data obtained from the questionnaires were coded, imputed into the computer and analyzed using SPSS 20.0 statistical software. Percentage and proportions were determined for categorical variables. Pearson's chi-square (test for association) was used to assess the significance of relationships between categorical variables. Students t test was used to compare continuous variables. P value less than 0.05 were considered to be statistically significant at confidence level 95%.

RESULTS

A total of 152 women being evaluated for infertility were recruited. The mean age was 35±5.56 years, the age range with the highest frequency was the 30-39 years, constituting 53.3% of the entire study population and the lowest frequency age range was 20-29 years (20.4%) (Table 1). The mean BMI of the study population was 29.5, 36 (23.7%) had a BMI of >25, while 116 (76.3%) had a BMI of <25. Forty women (26.3%) had hirsutism and 112 (73.6%) had normal female hair pattern (Table 1). Twelve (7.8%) had acne. Among the women 68 (44.7%) were oligo/amenorrhic while 84 (55.2%) had regular menstrual cycle (Table 1). Forty nine (32.2%) women had sonographic morphology of PCO.

Twenty two women (14.5%) had all oligo/amenorrhea, hirsutism and ultrasound findings of PCO. 11 women (7.2%) had both oligo/amenorrhea and ultrasound diagnosis of PCO only. 14 women (9.2%) had hirsutism and ultrasound diagnosis of PCO only and 3 women (1.9%) had hirsutism and oligo/amenorrhea only (Table 2). The prevalence of PCOS using the Rotterdam criteria was 32.8% (Table 2).

When compared, women with PCOS and women without PCOS had similar mean ages of 33.02±4.09 years and 32.71±5.00 years respectively (Table 3). The body mass index, ovarian stromal echogenicity and ovarian volume of women with PCOS was significantly larger than women without PCOS (p<0.001) (Table 3).

Table 1: Clinical characteristics of the study participants.

Variables	Frequency (n=152)	Percentage (%)
Age groups (years)		
18-29	31	20.4
30-39	81	53.3
40-50	40	26.3
Mean age (SD)	35 (5.56)	
Educational status		
Primary	6	3.9
Secondary	44	28.9
Tertiary	102	67.1
BMI (kg/m^2)		
<25	116	76.3
≥25	36	23.7
Mean BMI	29.5	
Presence of hirsutism		
Yes	40	26.3
No	112	73.7
Presence of acne		
Yes	12	7.8
No	140	92.1
Oligo/amenorrhea		
Yes	68	44.7
No	84	55.2
Polycystic ovaries on ultrasound		
Yes	49	32.2
No	103	67.8
Type of infertility		
Primary	60	39.5
Secondary	92	60.5

Table 2: Distribution of women based on features of the Rotterdam criteria for PCOS.

Variables	Frequency (n)	Percentage (%)
Oligo/amenorrhea positive USS finding of PCO positive Clinical hyperandrogenism	12	14.5
Clinical hyperandrogenism positive USS findings of PCO only	14	9.2
Oligo/amenorrhea positive USS findings of PCO only	11	7.2
Oligo/amenorrhea positive Clinical hyperandrogenism	3	1.9
Rotterdam criteria (diagnosis of PCOS)	50	32.8*

USS-ultrasound, PCO-polycystic ovaries, PCOS-polycystic ovarian syndrome; Rotterdam criteria for diagnosis of PCOS was at least the presence of two of the following three conditions oligo or anovulation (menstrual irregularity), clinical or biochemical signs of hyperandrogenism and polycystic ovaries on ultrasound; clinical hyperandrogenism was the presence of acne and/or hirsutism; *prevalence of PCOS in the study population.

Table 3: Comparison of women with and without PCOS (n=152).

Variables	PCOS (n=50) (%)	Non-PCOS (n=102) (%)	P value
Age (years)			
18-29	9 (18)	22 (21.6)	0.71*
30-39	29 (58)	52 (51.0)	
40-50	12 (24)	28 (27.5)	
Mean	33.02±4.09	32.74±5.00	
Educational status			
Primary	1 (2)	5 (4.9)	0.66*
Secondary	14 (28)	30 (29.4)	
Tertiary	35 (70)	67 (65.7)	
BMI (kg/m^2)			
<25	23 (46)	14 (13.7)	<0.001*
≥25	27 (54)	88 (86.3)	
Mean (SD)	29.2±9.44	24.5±6.1	
Ovarian volume$^{\#}$ (cm^3)			
<10	8 (16)	63 (61.8)	<0.001*
≥10	30 (60)	12 (11.8)	
Mean	11.322±3.39	8.89±2.04	
Ovarian stromal echogenicity$^{\#}$			
Normal	3 (6.0)	100 (98.0)	<0.001*
Hyper-echoic	47 (94)	2 (2.0)	
Follicular distribution$^{\#}$			
Peripheral	46 (72)	2 (2.0)	<0.001*
Random	4 (8)	100 (98.0)	

*Chi-square applied; $^{\#}$assessed on ultrasonography; PCOS-polycystic ovarian syndrome.

DISCUSSION

The prevalence of PCOS in this study was 32.8% which was similar to that of Ikpeme et al in Calabar with reported prevalence rate of 33.5% respectively.[10] These findings are at variance with that of Oriji et al Ugwu et al and Kechebelu et al who reported prevalence rates of 18.1% and 17.8% respectively.[11-13] The earlier study was tertiary hospital-based and the awareness and availability of advanced infertility treatments such as assisted reproductive techniques in such centers are probably responsible for the high prevalence, as these are most likely referral centers for many private and public primary and secondary hospitals in their regions.

About 40% of women who participated in the study had primary infertility while 60.5% had secondary infertility. This is similar to findings by Frank et al who recorded 40.8% and 67.2% of primary and secondary infertility respectively unlike Kechebelu et al who noted 24.6% and

74.4% of primary and secondary infertility, respectively.[13,14] Both Frank et al and Kechebelu et al found secondary infertility to be commoner than primary infertility, as also found in this study.[13,14] These may buttress the fact that secondary infertility is indeed commoner than primary infertility in Nigeria.

There was no difference in the mean age and educational status of women being evaluated for infertility with PCOS and those without PCOS, however women with PCOS had a significantly higher BMI when compared to women without PCOS (Table 3). This predisposition to more weight noted in women with PCOS when compared with women without PCOS is most probably explained by Hoeger et al following an assessment of many related studies.[15] Hoeger et al concluded that there is support for a predisposition to obesity by some data indicating impaired metabolism in PCOS women compared to weight matched controls but this data is limited. Contrary data also exist that adiposity rates do not vary between women with PCOS and those without and that differences in obesity rates between countries are more likely due to environmental and lifestyle factors.[15]

The proportion of infertile women with sonographically normal, non-polycystic ovaries was 67.8%. Carmina et al also reported a similar proportion of 69.1%.[16] Ovarian volume was 10cm^3 or more in 60% of women with PCOS and 11.8% of women without PCOS (Table 3). This was significant and similar to 63% in women with PCOS and 15% in non-PCOS women found by Abubakar et al.[17] An ovarian volume of 10cm^3 or more is one of the 3 criteria, 2 of which are needed and used to make a diagnosis of PCOS. This most likely explains the larger proportion of increased ovarian volume in women with PCOS compared to women without PCOS. Two percent of infertile women without PCOS had hyper-echoic ovarian stroma and peripheral distribution of follicles each on ultrasonography, features typical of women with PCOS. Broekmans et al reported that 4% of women without PCOS had hyper-echoic ovarian stroma while Igwegbe et al found that 6% of women without PCOS had peripheral distribution of ovarian follicles on ultrasound.[5,18]

CONCLUSION

Despite the wide spectrum of sonographic ovarian features and relatively higher BMI demonstrable in women with PCOS, they share similar socio-demographic profile with women without PCOS. A possible limitation of this study was the use of clinical features only to assess for hyperandrogenism. We did not test for biochemical hyperandrogenism which may occur in some women without clinical hyperandrogenism.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Udofia TA, Jinadu FO, Ottun AT, Olumodeji AM. Clinical and sonographic features in infertile women with and without polycystic ovarian syndrome. Int J Reprod Contracept Obstet Gynecol 2021;10:2437-42.