

## Clinicoradiological Profile of Patients with PCOS and its Association with Biochemical Parameters

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### ABSTRACT

**Background:** The incidence of polycystic ovarian syndrome is 4% to 22% of women overall and 50% of women seen at infertility clinics. Thus PCOS has evolved through many steps from the clinical, biochemical and imaging perspectives. Further, advances in imaging technology, particularly transvaginal sonography, have qualitatively enhanced the information on the internal structure of ovary and endometrial morphology.

**Aim & Objective:** To determine the association between sonological appearance of ovaries and endometrium with hormonal profile of the patients.

**Methods:** The Prospective study was conducted on hundred women having clinically the provisional diagnosis as polycystic ovarian syndrome. Evaluation of ovarian morphology and endometrium by pelvic ultrasonography by transvaginal and transabdominal.

**Results:** Out of 100 patients studied, the mean age of presentation was 24 years. The age range observed was between 15years to 35 years. Most (65%) of them were married compared to the unmarried (35%).(100%) had irregular periods particularly oligomenorrhea 52%. obesity which constituted about 37% of the patients followed by 18% of hirsutism and infertility 32%.31% of the patients belongs to group of 25 to 30 kg/m<sup>2</sup> i.e. overweight, 11% were obese i.e. >30 kg/m<sup>2</sup>. Maximum numbers of patients 65% were in the group of ≥12 follicles, 35% showed < 12 follicles. study 89 % of the patients showed normal or low levels of FSH. 69 % of the patients showed increased LH levels. There is significant rise in LH levels in patients with above 12 follicles (63%), with

follicular size 2-9mm (67%) and > 9mm (83%), ≥ 10mm stromal thickness (64.7 %), LH/FSH ratio was significantly greater in patients with more than 12 follicles (51%), stromal thickness >10mm. Increased LH/FSH levels are also observed in patients with 2-9mm follicular size, >10cc volume. Higher testosterone levels were observed in patients with ≥12 follicle, ≥10mm stroma thickness. This rise was statistically significant.

**Conclusion:** Thus this study concludes that the ovarian features on ultrasonography like follicular number, follicle size, and stromal thickness shows positive association with LH, LH/FSH and Testosterone.

**Keywords:** PCOS, Ultrasonography, LH, FSH.

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### Article History:

Received: 02-06-2016, Revised: 08-06-2016, Accepted: 18-06-2016

### Access this article online

Website: <a href="http://www.ijmrp.com">www.ijmrp.com</a>	Quick Response code 
DOI: 10.21276/ijmrp.2016.2.4.017	

### INTRODUCTION

Polycystic ovarian syndrome (PCOS) is a common endocrinopathy in women of reproductive age group and an incompletely understood enigmatic disorder of heterogenous nature. It starts appearing at 15 to 25 years of age and it may take years for its clinical presentation to appear. The incidence of polycystic ovarian syndrome is 4% to 22% of women overall and 50% of women seen at infertility clinics.<sup>1</sup>

PCOS is characterized by low follicle stimulating hormone levels resulting in anovulation, elevated luteinizing hormone levels, resulting in hyperandrogenism, and insulin-resistance symptoms which may range from simple cystic acne, cephalic hair loss, or mild facial hirsutism to instances of oligomenorrhoea or amenorrhoea, sterility and severe generalized hirsutism.<sup>2</sup>

Even after seventy years, the underlying cause for its heterogeneity and the development of signs and symptoms is not identified, the diagnostic criteria have yet to be universally agreed upon and the pathophysiology remains a point of intense research and debate.<sup>2</sup>

In clinical practice women with polycystic ovarian syndrome are seen for three major reasons<sup>2</sup>:

- Infertility (mean incidence 74%)
- Menstrual irregularities (mean incidence of dysfunctional uterine bleeding 29%, and amenorrhoea 51%)
- Androgen excess (mean incidence of hirsutism 69%, virilisation 21%)

Originally, according to Stein and Leventhal<sup>3</sup> (1935) the diagnosis required pathognomonic ovarian findings and the clinical triad of hirsutism, amenorrhoea, and obesity. The next diagnostic milestone occurred 30 years later, when researchers in the late 1960s and early 1970s noted derangements in the hypothalamo-pituitary axis. Following this the endocrine criteria were added to the diagnosis such as elevated levels of serum testosterone, and an elevated LH: FSH ratio.

Pelvic ultrasonography in the 1970s further added diagnostic specificity to the recognition of PCOS. Ultrasound features of polycystic ovaries were included as a diagnostic criterion following

the Rotterdam Consensus meeting for PCOS diagnosis in 2003.

The three criteria included in the definition were:<sup>4</sup>

- oligo and/or anovulation;
- hyperandrogenism
- polycystic ovaries with the exclusion of other etiologies.

This definition required at least the presence of two from the above three criteria.

Thus PCOS has evolved through many steps from the clinical, biochemical and imaging perspectives. Further, advances in imaging technology, particularly transvaginal sonography, have qualitatively enhanced the information on the internal structure of ovary and endometrial morphology.

With this background, the present study was undertaken to identify and assess the sonological features in patients with clinical features of polycystic ovarian syndrome.

## METHODOLOGY

The Prospective study was conducted in department of Obstetrics and Gynaecology J.L.N. Medical College, Ajmer from 1<sup>st</sup> June 2014 to 31<sup>st</sup> May 2015 on hundred women having clinically the provisional diagnosis as polycystic ovarian syndrome. Evaluation of ovarian morphology and endometrium by pelvic ultrasonography by transvaginal and transabdominal (in those patients where transvaginal was contraindicated) in reproductive age group.

Patients referred from Obstetrics and Gynecology and Endocrinology departments with clinical suspicion of features of polycystic ovarian syndrome for pelvic sonography.

The specific inclusion criteria included were the following:

- Female patients in reproductive age group (15 – 35 years)
- Irregular or no Menstrual periods
- Hirsutism / Acne (Androgen excess)
- Infertility
- Obesity

Known cases of Polycystic ovarian syndrome on treatment and follow up, less than 15 years or greater than 35 years age group, patients with other known or incidentally detected health problems, patients without hormonal investigations, patients lost for follow up. The study was performed using GE- VOLUSON 730 PRO, GE LOGIQ 500PRO ultrasound scanners using convex probes of frequency ranging from 3 to 5MHz for TAS and curved probes of frequency ranging from 7 to 10MHz for TVS. The results of the descriptive analysis were presented in numbers, percentages and as Mean  $\pm$  SD (Min-Max). Chi-square test was used to find the association between clinical, radiological and biochemical parameters.

## RESULTS

The present study showed majority (64%) of the patients were below 25 years (table 1). Most(65%) of the patients showed more than 12 follicles per ovary and peripheral arrangement of the follicles was the most common finding in these patients (table 2) and 14 % had stromal thickness more than 10mm. Stromal thickness range was 6mm to 13mm (table 3). In our study 89% of the patients showed normal or low levels of FSH values & Blood sugar levels were increased in 21% of the patients (table 4).

**Table 1: Age distribution of the patients**

Age in years	Number of patients	%
15-20	29	29
21-25	35	35
26-30	27	27
31-35	9	9
<b>Total</b>	<b>100</b>	<b>100.0</b>

**Table 2: Arrangement, number and size of the follicles per ovary**

Follicle distribution	Number of patients	%
Peripheral	100	100
Irregular	0	0
<b>Total</b>	<b>100</b>	
<b>Number of follicles</b>		
<12	35	35
$\geq$ 12	65	65
<b>Total</b>	<b>100</b>	<b>100</b>
<b>Range of follicle numbers : 10-20</b>		
<b>Follicle size(in mm)</b>		
<2.0	0	0
2.0-9.0	88	88
>9.0	12	12
<b>Total</b>	<b>100</b>	<b>100</b>
<b>Range of follicular size - 2mm to 10mm</b>		

**Table 3: Volume, Stromal thickness and character of the ovary**

Volume of the ovary (in cc)	Number of Patients	%
<10	45	45
$\geq$ 10	55	55
<b>Total number</b>	<b>100</b>	
<b>Stromal thickness &amp; Character</b>	<b>Number of Patients</b>	<b>%</b>
<b>Stromal thickness</b>		
<10	86	86
$\geq$ 10	14	14
<b>Total</b>		
<b>Character</b>	<b>Number of Patients</b>	<b>%</b>
Echogenic	97	97
Hypoechoic	3	3

Table 4: Distribution of Patients according to Hormones

Hormones	Number of patient	%	Reference value
<b>FSH</b>			
≤10.5 mIU/L	89	89	Proliferative 3.3-8.8m IU/ml
>10.5m IU/L	11	11	
<b>LH</b>			
≤ 6.2 IU/L	31	31	Proliferative 0.6-6.2mIU/ml
> 6.2 IU/L	69	69	
<b>LH/FSH</b>			
≤ 2:1	59	59	2:1
> 2:1	41	41	
<b>TSH</b>			
≤6.5 uIU/ml	94	94	0.3-4.5uIU/ml
>6.5 uu/ML	6	6	
<b>TESTOSTERONE</b>			
≤8.1ng/ml	27	27	1.5-8.1ng/ml
>8.1ng/ml	73	73	
<b>PROLACTIN</b>			
≤20 pg/ml	88	88	3-20ng/
>20 pg/ml	12	12	
<b>RBS</b>			
≤120 mg/dl	79	79	80-120mg/dl
>120 mg/dl	21	21	

Table 5: Association between Ovarian features and LH/FSH

Ovarian Features	Criteria	Total Number	LH/FSH		Pvalue
			≤ 2:1 (n=59)	>2:1 (n=41)	
Number of Follicles	<12	35	27(77.14)	8(22.85)	0.0068
	≥12	65	32(49.24)	33(50.76)	
Follicle size	<2.0	-	-	-	0.63152
	2.0-9.0	88	52(59.09)	36(48.91)	
	>9.0	12	7(58.33)	5(41.66)	
Stromal Thickness	<10	86	51(59.30)	35(40.69)	0.02834
	≥10	14	8(57.40)	6(42.85)	
Volume of Ovary	<10	45	27(60)	18(40)	0.85585
	≥10	55	32(58.18)	23(46.4)	

The study observed that 51% of the patients with more than 12 follicles showed positive and statistically significant increase in LH//FSH ratio (table 5).

## DISCUSSION

The present study observed that Majority (64%) of the patients were below 25 years. The maximum numbers of patients were in the age group of 21-25 years (35%). Similar results were observed by Luciano G. Nardo & William M. Buckett,<sup>5</sup> the mean age was 31 ±3.1years with age range of 26 to 37 years.

In study done by S. Jonard, Y. Robert<sup>6</sup> the age range was 21 to 34 years with a median age of 27 years. It is a prospective study of 214 patients of polycystic ovarian syndrome.

Range of age was 14 to 37 years with a mean age of 24 years in a study of patients diagnosed as having polycystic ovarian syndrome by Hsu-Chong Yeh and Walter Futterweit.<sup>7</sup>

The range of follicle number observed in the present study was between 10 and 20, with a mean of 12 ± 2. Maximum numbers of patients 65% were in the group of ≥12 follicles, 35% showed < 12

follicles. This cut off point was taken as per the Rotterdam consensus definition of polycystic ovarian syndrome.

If the cutoff point was ≥ 10 follicles following the criteria of Adams et al,<sup>8</sup> 100% of the patients in the present included in this group.

The Present study showed peripheral distribution of follicles in 100% of the patients. This observation was seen in many other studies by Adams J<sup>8</sup>, 60% in peripheral distribution and 40 % in irregular distribution, Ardaens Y.<sup>9</sup> 55% in irregular and scattered, 45 % in peripheral distribution, Hann LE<sup>10</sup> 73% in peripheral distribution.

The range of follicle size in this study was between 2 to 10mm. This could be because of the insensitivity of the ultrasound machine to detect the follicles less than 2mm.

This observation was supported by other studies by Adams & Polson et al,<sup>8</sup> whose studies observed 2-9mm was the most common (> 60%) follicular size in patients with polycystic ovarian syndrome. Hann et al<sup>10</sup> found that mean follicular size was 5mm±1, with range 2 to 12mm, and most common follicular size observed was 2-9mm (80%).

In this present study <10 mm stromal thickness was seen in majority (86%) of the patients, whereas  $\geq 10$  mm was seen in 14% of the patients. A study by Ardaens et al<sup>9</sup> subjectively assessed the echogenicity and confirmed with transvaginal scan. In the study by Pacheet al<sup>11</sup> increase in stromal echogenicity was found in 55%, with  $\geq 10$  mm as the cutoff point.

The volume range observed in the present study was between 7 to 14 mm. This observation was supported by Adams et al,<sup>8</sup> most 70% of the PCOS patients showed  $\geq 10$ cc. Hann et al.,<sup>10</sup> study showed  $\geq 10$ cc in 71% and normal ovarian volume in about 29%.

The subjective evaluation of the stroma in this present study showed echogenic and thickened in 97% of the patients and nonechogenic and thin in 3% of the patients. This observation was supported by Ardaens et al.<sup>9</sup>

In this present study 89 % of the patients showed normal or low levels of FSH. 69 % of the patients showed increased LH levels. These results are comparable to other studies by Miguel Dolz and Van DeWesthuitzen<sup>12</sup>.

Even though statistically not significant the present study observed a positive association between low FSH and sonological ovarian features. FSH levels were lower to normal in patients with  $\geq 10$  cc (91%) volume,  $\geq 10$  mm stromal thickness (93%) and with follicle size between 2-9mm 89.77%.

The number of follicles, follicular size, stromal thickness and the volume of ovary showed negative association with the rise of TSH and prolactin levels. And this is not statistically significant.

The follicular size and volume of the ovary showed no association with the rise in blood sugar levels. Whereas the follicular number shown weak positive association but is statistically not significant. In the study by Luciano G. Nardo,<sup>5</sup> the total ovarian volume, total follicular volume and follicular number associated well with the LH and FSH. A study by Miguel Dolz<sup>12</sup>, observed statistically significant association between LH and follicular number and LH, LH/FSH ratio.

Tahashi et al<sup>13</sup> and Battaglia et al<sup>14</sup> noted a positive association between number of small follicles (2-8mm) and serum androstenedione and LH/FSH ratio. Pache et al<sup>11</sup> found positive association between testosterone and LH with number of follicles >2mm. This increase in follicle number and increase in stroma because of hyperandrogenism (raised testosterone levels) adds to the bulk of the ovary. The reason for the increase in endometrial thickness could be prolonged exposure to excessive estrogen levels and also irregular periods i.e. increase in the length of the cycle.

## CONCLUSION

Thus this study concludes that the ovarian features on ultrasonography like follicular number, follicle size, and stromal thickness shows positive association with LH, LH/FSH and Testosterone.

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**Source of Support:** Nil. **Conflict of Interest:** None Declared.

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**Cite this article as:** Vandana Maurya, Kanti Yadav. Clinicrodiological Profile of Patients with PCOS and its Association with Biochemical Parameters. Int J Med Res Prof. 2016; 2(4):72-75.