Polycystic Ovarian Syndrome (PCOS): Ultrasound Findings and Hormonal Assay Result

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Abstract
PCOS is a syndrome of ovarian dysfunction along with the cardinal features of hyperandrogenism and polycystic ovary morphology. The etiology of PCOS is not completely clear, but there is often a family history. The objective of this study is to see what type of symptoms that are linked to PCOS and lead the patient to look for physician help, second how does the history, ultrasound findings and hormonal test result to establish the diagnosis of PCOS. A field study was conducted on 30 female patients attending Al-Zhraa and Al-Karama Teaching Hospitals, and subjected to collection of the history and biochemical and hormonal profile of these patients through blood samples and ultrasound features. The results revealed that 26 (87%) had oligomenorrhea and 4 (13%) had amenorrhea, 21 (70%) had acne, 10 (33%) had hirsutism and 19 (63%) suffered obesity 12 (40%) had positive family history and 16 (53%) were married, 13 (43%) had normal ovarian volume, 17 (57%) had increased ovarian volume and 30 (100%) had multiple cysts distributed over the ovarian, 28 (93%) had elevated Luteinizing Hormone (LH) levels, 16 (53%) had low Follicle stimulating hormone (FSH) levels and 14 (47%) had normal FSH levels, 18 (60%) had elevated testosterone levels and 12 (40%) had normal testosterone levels. In conclusion, PCOS has many clinical features such oligomenorrhea, amenorrhea, hirsutism, acne and obesity and the ultrasound features include multiple cyst distributed over the ovarian and/or changes to ovarian volume and increased echogenicity other features include biochemical changes, obesity is a very common finding in patient with PCOS and family history is also important in diagnosis so it is very important to suspect PCOS in obese patient with family history of PCOS and menstrual abnormality and establishing the diagnosis with ultrasound findings although not all these features can be represented in single patient.
Keywords: Hyperandrogenism, Ovary, Biochemical profile, Hormonal profile, Iraq

Introduction

PCOS is a disease in which the ovaries are not functioning well along with the clinical features of excess androgen and polycystic ovary morphology. Its clinical picture includes menstrual abnormality, signs of androgen excess (e.g. hirsutism) and obesity. In addition, there are biochemical changes such as Elevated serum LH levels and insulin resistance. PCOS is associated with an increased risk of type 2 diabetes and cardiovascular events. It affects around 5 –10 per cent of women of reproductive age. The prevalence of polycystic ovaries seen on ultrasound is much higher at around 25 per cent [1] with polycystic ovarian syndrome patient there seems to be another family member that had the same disease, which

probably mean that there is a gene involved, According to the National Institutes of Health Office of Disease Prevention PCOS is a complex disease in which 7% of adult women in reproductive age are being affected by it, around 5milion women of childbearing age have PCOS in the US [2]. Research suggests that 5% to 10% of females 18 to 44 years of age are affected by PCOS and based on those researches PCOS is considered the most common endocrine abnormality amongstwomen in that age [3].

The etiology of PCOS is complex due to the interaction of many genetic and environmental agents that develops the syndrome although the genetic factors remain unclear but in some cases there is a family history involved. The pathophysiology of PCOS involves disturbance in the hypothalamic–pituitary axis and disturbance in insulin secretion and action accompanied by obesity and poor dietary choices, over secretion of insulin lead to ovaries over producing androgens which lead to anovulation, the most important evidence that establish the ovarian abnormality is Follicular maturation arrest [4]. The clinical features of PCOS are as follows, oligomenorrhea / amenorrhea in up to 75 per cent of patients, predominantly related to chronic anovulation and Amenorrhea is defined as the absence of menstruation, Primary amenorrhea is when girls fail to menstruate by 16 years of age. Secondary amenorrhea is absence of menstruation for more than six months in a normal female of reproductive age that is not due to pregnancy, lactation or the menopause polycystic ovarian syndrome is one of the causes to secondary amenorrhea [1], hirsutism which is defined as a condition of unwanted, male-pattern hair growth in women. Hirsutism results in excessive amounts of dark, course hair on body areas where men typically grow hair face, chest and back other causes of hirsutism must be excluded in order to reach a proper diagnosis of PCOS, whichinclude drug exposure, smoking, idiopathic and obesity [5], subfertility affects one in seven couples It can be defined as failure to conceive after regular sexual intercourse for one or two years in the absence of any known reproductive pathology. The diagnosis of subfertility based on failure to conceive in one year can exaggerate the risk of subfertility as a further 50 per cent of couples will fall pregnant in the subsequent year [1] obesity in at least 40 per cent of patients in a study about Presenting Features of Polycystic Ovarian Syndrome in Iraqi Obese Females amongst 756 patient 14.3% of them had PCOS [6]. Acanthosis nigricans (areas of increased velvety skin pigmentation occur in the axillae and otherflexures) or may be asymptomatic [1].

For diagnosing polycystic ovarian syndrome, it relies on clinical features and Rotterdam criteria:Patients must have two out of the three features below

- Amenorrhea/oligo menorrhea
- Clinical or biochemical hyperandrogenism
- Multiple small peripheral custs over the ovaries on ultrasoundIn addition, score two of three of the Rotterdam criteria

1. Oligo- or anovulation
2. Clinical and/or biochemical signs of hyperandrogenism
3. Multiple small peripheral cysts over the ovaries on ultrasound and exclusion of other etiologies (congenital adrenal hyperplasia, androgen-secreting tumors, Cushing syndrome) [7].

The ultrasonic criteria for PCOS were reviewed in 2003 Balen and coworkers suggested the presence of multiple small peripheral follicles distributed over the ovaries with diameter of 2-

9mm and/or increase in the ovarian volume [8]. Many studies were carried out to establish the presenting features of polycystic ovarian syndrome for example Himabindu Sangabathula, Neelima Varaganti did a study about 100 cases of polycystic ovarian syndrome and they found 78 of their patients suffered menstrual abnormality [7] which as previously mentioned is due to chronic anovulation which based on thisstudy is considered a very important clinical feature to diagnosing polycystic ovarian syndrome other prominent features that they found where 48 with hirsutism, 10 with acne which means most of these symptoms are general in nature and the patient might go to the hospital without a previous diagnosis of PCOS . Obesity observed in 56, infertility is the presenting complaint in 54 patients and acanthosis nigricans observed in 14 patients and total testosterone is elevated [7].

Over the past 3 decades there has been an increase in studies and researches and prevalence of this syndrome amongst patient which were recognized as common in internal medicine practicesit showed that it effect multiple body symptoms and requires a very good knowledge to diagnoseand treat this syndrome many other association with this syndrome include insulin resistance and diabetes, hyperlipidemia, hypertension, fatty liver, metabolic syndrome, and sleep apnea endometrial hyperplasia, and cancer [9]. As for the management of polycystic ovarian syndrome, Therapeutic considerations put a great care in managing menstrual abnormality, hyperandrogenism, and preventing the consequences of this syndrome [10], which means managing PCOS requires multi systemic approach and managing the psychologicaland social impact of the syndrome like depression and eating disorder as well as treating cosmetic effects like hirsutism, androgenic alopecia and acne [9]. One way of management is to use statin which has shown good result regarding lowering testosterone levels alone or if used with oral contraceptive pills but it does not cure menses, spontaneous ovulation, hirsutism, or acne. To restore regular menses a life style modification is required the most important one is weight reduction as shown if the weight is reduced by 5% it can help restore menses and improve response to ovulation- inducing and fertility medications (11) and weight reduction can help the patient to avoid the diabetes mellitus and cardiovascular problems which develop later in life Metformin this is beneficial in a subset of patients with PCOS, those with hyperinsulinemia and cardiovascular risk factors. It is less effective than clomiphene for ovulation induction and it doesnot improve pregnancy outcome. It should be discontinued when pregnancy is detected and Clomiphene can be used to induce ovulation where subfertility is a factor [1] sometimes the approach to managing PCOS is based on patient desire especially if there is planning for pregnancy [12].

Induction of ovulation with antiestrogens such as clomiphene citrate or letrozole is the first-line medical treatment and as second line Exogenous, gonadotropins and in vitro fertilization (IVF) are recommended [13].

Combined oral contraceptive is the most used modality of treatment in PCOS for its proved results in suppressing androgen production and improving menstrual abnormality on the other hand, it could decrease insulin sensitivity, which can possibly deteriorate glucose tolerance [14]. In conclusion effects of medical therapy on PCOS patient is the following insulin resistance and inflammatory markers and endothelial function can all be improved by metformin on the other hand the oral contraceptive pills worsens insulin resistance and glucose homeostasis, inflammatory markers, and triglycerides and has neutral or positive

endothelial effects and unclear effect on cardiovascular risk [15]. The objective of this study is to see what type of symptoms that are linked to polycystic ovarian syndrome and lead the patient to look for physician help, second how does the history, ultrasound findings and hormonal test result establish the diagnosis of polycystic ovarian syndrome.

Materials and methods

Study samples

Afield study carried out to collect the data from patient attending the surgical, medical and gynecological ward at both Al-Zahra and Al-Karama Teaching Hospitals. The patient were all females there ages within 27-39 years old all of the cases were not on previous medications, the researcher collected the patient history presenting symptoms, ultrasound findings and hormonal test results from each patient individually. After the patient were sent to ultrasound due to suspicion of PCOS the researcher wrote the results in details regarding the changes to ovarian volume and/or presence of multiple cysts over the ovaries and recorded the case as a PCOS afterthe specialist approves the diagnosis after that the patient undergo a hormonal analysis the following hormone results that were collected include Luteinizing Hormone, Follicle stimulating hormone, and testosterone levels after the sonogram and hormonal analysis the researcher took the patient history looking for menstrual disturbances and other symptoms such as hirsutism and acne their marital status and age were also collected.

Inclusion criteria

1.   Menstural changes.
2.   Hormonal changes.
3.   Presence of multiple small peripheral follicles distributed over the ovaries and around dense core of stroma with increased echogenicity and/or changes to ovarian volume, which was detected by ultrasound.

Exclusion criteria

1.   Cushing syndrome
2.   Congenital adrenal hyperplasia 3-androgen secreting tumors
3.   All the data were collected in the time period of three months July, august and September of 2019 the data were tabulated means and percentages used and the results were analyzed using spss v25 program.

Results

Regarding patient history and presenting symptoms 26 (87%) had Oligomenorrhea and 4 (13%) had amenorrhea, 21 (70%) had acne and only 10 (33%) had hirsutism, out of those 10 patent 5 of them had both acne and hirsutism at the same time, 19 (63%) of these patient suffered obesity there BMI was above 30 and 11 (37%) were under BMI 30, 12 (40%) had a positive family historywith at least one of their family members had the same syndrome, 16 (53%) were married and 14 (47%) were unmarried, the researcher made correlations regarding these results, p value for this table was at the level of 0.05 (Table 1).

Table 1: Clinical history of study population

Symptom	No. of symptomatic patients	No. of asymptomatic patients
Oligomenorrhea	26 (87%)	4 (13%)
Amenorrhea	4 (13%)	26 (87%)
Acne	21 (70%)	9 (30%)
Hirsutism	10 (33%)	20 (67%)
Obesity	19 (63%)	11 (37%)
Family history	12(40%)	18(60%)
Marital status	16(53%)	14(47%)
P value for this table is 0.05		

Regarding the ultrasound findings 13 (43%) had normal ovarian volume, 17 (57%) had increased ovarian volume and 30 (100%) of these patient had multiple small follicles distributed over the ovarian and around a dense core of stroma with increased echogenicity on ultrasound amongst ahigh number of patient and the cysts diameter were ranging between 2-9 mm, correlations were made regarding these results, p value for this table was statistically significant at the level of 0.01 less than 0.05 (Table 2).

Table 2: Ultrasound results of study population

Ultrasound findings	No. of positively ultrasound patient	Number of negatively ultrasound patients
Normal ovarian volume	13 (43%)	17 (57%)
Increased ovarian volume	17 (57%)	13 (43%)
Multiple small Peripheral cysts Disrupted over	30 (100%)	0
P value for this table is statistically significant at the level of 0.01 lessthan 0.05		

In table 3 regarding hormonal assay results we can see that 28(93%) of the patients had elevatedLH levels and 16(53%) of them had low FSH levels with 14 (47%) had normal FSH levels, 17 (57%) had high estrogen levelsand 13 (43%) had normal estrogen levels 18 (60%) of these patient had elevated testosterone levels and 12(40%) had normal testosterone levels, p value result for this table was at the level of 0.01 less than 0.05 which makes it statistically significant

Table 3: Hormonal results of study population

Hormone	No. of patient with normal hormone levels	No. of patient with highhormone levels	No. of patient with lowhormone levels
LH	(7%) 2	28 (93%)	0
FSH	14 (47%)	0	16 (53%)
Testosterone	12 (40%)	18 (60%)	0
P value for this table is statistically significant at the level of 0.01 less than0.05			

Discussion

The most common clinical features that are seen in the patients are menstrual abnormality such as oligo menorrhea and amenorrhea and other physical features such as acne and hirsutism, oligo menorrhea is in 26 (87%) of the patients compared to other studies where they found that oligo menorrhea is present in 85% of their patients [7] and in another study about Prevalence and Presenting Features of Polycystic Ovarian Syndrome in Iraqi Obese Females they found that oligo menorrhea is present in 94.4% of their patients, all these studies compared to our study shows that menstrual abnormality is very important clinical feature of polycystic ovarian syndrome most of it being represented as oligo menorrhea and in another study done by Balen oligo menorrhea is found in 47% of the cases [16]. The reason for this lower frequencyof oligo menorrhea in patients of Balen was the presence of other menstrual irregularities like amenorrhea in greater proportion in their patients. Where they found that amenorrhea is present in 19.2% in their patients compared to our study where found amenorrhea in only 4 (13%) of our patients and in another study carried out by Fauzia on Pakistani patients oligomenorrhea was found in 75% of their cases [17] which is comparable to 26 (87%) in our patients. Although oligomenorrhea and amenorrhea so far has been very common in many studies patient with polycystic ovarian syndrome can be with normal menses in study carried out by balen [16] they found 29.7% of their patients had normal menses compared to our study where no patient had normal menses this difference could be due to the fact that there is ales number of patient were viewed in our study or could be to the different criteria of patient selection.

Hirsutism is present in 10 (33%) of our patient compared to the study done by Himabindu Sangabathula, Neelima Varaganti they found hirsutism in 52% of their patients [7] the low percentage of hirsutism in our patients can be attributed to the less number of patients that are in our study opposite to their 100 cases and in another study Hirsutism is present in 66.2% patients of Balen [16] which is again higher than our percentage and also can be attributed to their patients number, 5 of those 10 patient is with both acne and hirsutism at the same time and in another study done about Prevalence and Presenting Features of Polycystic Ovarian Syndrome in Iraqi Obese Females they found 63% of their patient had hirsutism due to the fact they viewed 756 patient [6].

Acne is present in 21 (70%) of our patient compared to Himabindu Sangabathula, Neelima Varaganti study where they found acne in only 4 patient of the 100 cases [7] and in our study 5 of those 21 patient had both acne and hirsutism at the same time. Obesity is present in 19(63%) of our patient out of 30 patient compared to study about Prevalence and Presenting

Features of Polycystic Ovarian Syndrome in Iraqi Obese Females they found that out of 756 of the patient attending the Obesity research and therapy unit (ORTU) (14.3%) of them had PCOS [6] they had 756 patient compared to 30 patient in our study which explains the difference in results between the two studies and in study carried out by Himabindu Sangabathula, Neelima they found that 57% of their patient had obesity [7].

12(40%) is with a positive family with at least one of their family members or close relative had the same syndrome which as we previously mentioned that there seems to be some gene involved alongside the environmental factors compared to a study about the possibility of family history as a risk factor for PCOS where they found 35% of mothers and 40% of sisters of patients with PCOS will be affected by PCOS themselves [18], 16 (53%) of our patient are married which could have a massive impact on their marriage with infertility being one of consequences of PCOS compared to study to about the effect of this syndrome on marriage life where they found that amongst the symptoms of PCOS infertility was stopping point for most of the marriages [19]. Correlations are made between all the data from table 1 the result was that p value for the presenting symptoms that are collected in this study is at the level of 0.05 that could be due to some good number of patients is with negative symptoms for with PCOS not all these symptoms are represented in a patient the patient in some cases could be asymptomatic 13 (43%) of our patients has normal ovarian volume and 17(57%) of our patient has increased ovarian volume compared to Himabindu Sangabathula, Neelima Varaganti study they found that 26.6% had normal ovarian volume and 57.8% had increased ovarian volume [7] the type of ultrasound that was used in most of our patient was transabdominal ultrasound which is more operator dependent and less sensitive unlike transvaginal ultrasound which more sensitive an accurate but the preference of transabdominal ultrasound is due to socioeconomic status of the patient and in unmarried patient it is preferable to use transabdominal ultrasound 100% of our patient has multiple small peripheral cysts distributed over the ovaries and around dense core of stroma the reason for that was due to selection criteria of patient where only the patient with their ultrasound report indicate the presence of multiple small follicles and the specialist approves the diagnosis of polycystic ovarian syndrome. For table 2 correlations are made and the result is that p value is statistically significant at the level of 0.01 which makes ultrasound investigation very important in diagnosing, in a study conducted to see ovarian stromal echogenicity in women with normal and polycystic ovarian syndrome there ultrasound results were significant at the level of less than 0.05 (20) which means it is best to look for echogenicity changes within the ovaries 28(93%) of our patient has elevated Luteinizing Hormone levels and 2 (7%) has normal hormone level compared to the study of Prevalence and Presenting Features of Polycystic Ovarian Syndrome in Iraqi Obese Females where they found that The mean serum LH and LH were higher in women with PCOS compared with the normal group and In there study the LH/FSH increased with increasing BMI although both mean ratios (BMI less and more than 30) were high which is the usual pattern of hormonal abnormality in PCOS [6] 16 (53%) has low Follicle stimulating hormone levels and 18 (60%) had elevated testosterone levels compared to Himabindu Sangabathula, Neelima Varaganti study where they found that only 27% of their patient had elevated levels of testosterone [7] the les percentage of testosterone levels in their study was due to the fact that they depend on

total serum testosterone assays rather than free testosterone assays(due to availability issues), and different commercial kits have different cut off values and in another study about Prevalence and Presenting Features of Polycystic Ovarian Syndrome in Iraqi Obese Females Mean serum total testosterone concentration was significantly higher in the PCO group and was the most frequently (70%) abnormal hormonal marker for PCOS (6), correlations were made regarding results in table 3 the p value for the data was statistically significant at the level of 0.01 less than 0.05 which alongside table 1 results we can see that history and presenting symptoms and hormonal assay results are very significant to establish the diagnosis of polycystic ovarian syndrome.

Conclusion

In conclusion polycystic ovarian syndrome is a syndrome not just a disease it has group of symptoms, which consistently occur together, first we have menstrual abnormality presenting as oligo menorrhea and amenorrhea and some patient might have normal menses, second there is biochemical changes presenting as hyperandrogenism like hirsutism and acne, third there is morphological changes within the ovaries such as changes to ovarian volume and multiple small peripheral cyst distributed over the ovaries and changes to echogenicity of ovarian stroma , as we can see from this study these symptoms can happen all at once or not some patient might go to the doctor for just acne and menstrual changes and the diagnosis ends up to be polycystic ovarian syndrome, it is very important to do a good history and proper investigations and it is very important to take notice on diagnosing PCOS in females with these set of symptoms a study suggested to stress on diagnosing PCOS in adult female during management of obesity for obesity is a common finding in women with PCOS and between 40 –80% of women with this condition are reported to be overweight or obese, ultrasound is very important investigation to establish the diagnosis to detect the morphological changes that occurs within the ovaries.

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