Prevalence and ultrasound features of polycystic ovaries in young females examined by pelvic ultrasound in primary health care in Qatar. Electronic Medical record-based study

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Abstract

Background and study aim: PCOS is a common recognized, heterogeneous disorder affecting women throughout their lifetime and it shows an excess production of androgens hor¬mone, ovulatory dysfunction and polycystic changes of the ovaries which can be seen by ultrasonography.

Ultrasound is the first imaging modality widely used in pelvic imaging. It is a non-invasive, rapid, painless, and safe imaging technique with no radiation.

The aim of this study is to estimate the prevalence and ultrasound features of PCOS among young females.

Patients and Methods: A Multi-center retrospective descriptive electronic record-based study for all subjects with a valid ultrasound of the ovaries done in PHCC health centers from 1 January 2021 to 31 December 2021.

The available pelvic ultrasound images were assessed for presence of PCOS sonographic criteria.

Prevalence of PCO was calculated. The sonographic features of PCO were described.

Results: The current study showed prevalence of PCO among young female with age ranging from 15 to 35 years, to be 6.85% with the majority of cases being bilateral. While unilateral cases were more in the right ovary.

Cases with PCO peripheral follicular arrangement were found to be the highest described sonographic finding in PCO cases.

Conclusion: Ultrasound plays a major role in PCO diagnosis. The assessment of the ovaries has been greatly improved by sonographic diagnostic criteria of PCO. In addition to demonstration of ovarian size, ultrasonography can evaluate the characteristic patterns of follicles distribution and ovarian stromal changes.

Key Words: Prevalence, PCO, US, Pelvis, Qatar.

Abbreviations:
PCO: polycystic ovaries.
PCOS: Polycystic ovarian syndrome
US: ultrasound
LH: luteinizing hormone
PHCC: primary health care corporation.

Background

Polycystic ovarian syndrome (PCOS) is a condition of ovarian dysfunction that was first described by Stein and Leventhal in 1935 when they described a group of women with amenorrhea, hirsutism, and enlarged ovaries with multiple cysts. Currently, PCOS is a common recognized, heterogeneous disorder affecting women throughout their lifetime and it shows an excess production of androgens hor¬mone, ovulatory dysfunction and polycystic changes of the ovaries which can be seen in ultrasonography (1-10).

PCOS is now the most common reproductive endocrinal abnormality in women during their childbearing years and is considered as an endocrine disorder which can be attributed to a combined factor of genetic and environmental nature with many risk factors reported. On the top is obesity, sedentary lifestyle together with familial history (1-3, 10-17).

The European Society of Human Reproduction (in Rotterdam) and the American Society of Reproductive Medicine has proposed some criteria to establish the diagnosis of PCOS, that is in the presence of two of the following: Oli¬gomenorrhea or amenorrhea, clinical features, or/and biochemical signs of hyperandrogenemia/ hyperandrogenism, and sonographic findings of polycystic ovarian changes (2-4).

Transvaginal ultrasound (TVUS) is considered the gold standard in the diagnosis of PCOS. The sonographic features include increased number of follicles per ovary; the follicles are generally of similar size and their diameter ranges from 2-9 mm; follicles are peripherally distributed giving a “string of pearls” appearance; increased ovarian volume (>10 mL) and echogenic dense central stroma (2,15).

Qatar is experiencing a fast development with mega projects that has led to a high influx of migrants and professionals from different countries resulting in a multi-ethnic young adult population with continuous and high demographic turnover (18). This would reflect substantially on the epidemiology and clinicopathologic characteristics of Qatar’s prevalent diseases. To date, to the best of our knowledge there no similar study has been conducted to estimate the prevalence and ultrasound features of PCOS in Qatar.

Ultrasound is the first imaging modality widely used in pelvis imaging. It is a non-invasive, rapid, painless, and safe imaging technique with no radiation. The vision of PHCC is to be the leader in transforming the health and wellbeing of people’s lives in Qatar. The corporation provides pelvic ultrasound services in most of its health centers and one of the important referral reasons of pelvic ultrasound is the evaluation of endocrine abnormalities, including polycystic ovaries.

Aim of the work:
The aim of this study was to estimate the prevalence and ultrasound features of PCOS among young females subjected to pelvis ultrasound in PHCC and to recognize the sonographic features of PCOS.

Patients and Methods

A multi-center retrospective descriptive electronic record-based study for all subjects with a valid ultrasound of the ovaries done in PHCC health centers from 1st January 2021 to 31st December 2021.

Study Population
- Inclusion criteria:
The inclusion criteria of the study was young females (15 to 35 years) who underwent a pelvis ultrasound scan in PHCC Radiology Departments for any reason. A valid pelvis ultrasound scan image should be available on the official PHCC electronic medical record system (RIS PACS system) during the study period from 1st January to 31st December 2021.

- Exclusion criteria:
The exclusion criteria was (as documented on CERNER) patients with non-available ovarian ultrasound images, history of surgery on the ovaries or any ovarian masses.
The available pelvis ultrasound images were assessed for presence of PCOS sonographic criteria.

A positive PCO case was considered in the presence of two of the following: Oli¬gomenorrhea or amenorrhea, clinical features, or/and biochemical signs (hyperandrogenemia/ hyperandrogenism) and sonographic findings of polycystic ovarian changes (2-4).

A random sample of 100 scans was evaluated by the two consultant radiologists participating in this study to determine the percentage agreement among them and document the validity of diagnosis reported.

The results of ultrasound images assessment by a study team member radiologist were recorded and compared immediately with the original radiologist report available. If the opinion of the reviewing radiologist agreed with that available in the attached report, then the data was verified and signed off. If there was a discrepancy between the two, then a third opinion was needed from the other research team member.

The one-year prevalence rate (per 100 persons) of positive PCOS was calculated:

Prevalence = (Count of subjects with a positive PCO/ Count all subjects evaluated with a valid ultrasound scan) X 100.

The data was delivered in an Excel sheet. Statistical analysis was computed using IBM SPSS version 23 computer software.

Results

The current study included 8,635 young females with age ranging from 15 to 35 years who were subjected to pelvis ultrasound in PHCC from 1st January to 31st December 2021. Polycystic ovaries were detected at ultrasound in 591 cases (6.85%), in 75.6% of cases they wer bilateral while 24.4 % were unilateral. Unilateral cases affected right ovary in 64.6 % while left ovary was the only one involved in 35.4%.

Cases with PCO at right ovary showed ovarian volume of more than 10 cc in 79%, follicles number of more than 12 in 81 %, dense stroma in 79.4% and peripheral follicular arrangement in 89.8%.

Cases with PCO at left ovary showed ovarian volume of more than 10 cc in 75.3%, follicles number of more than 12 in 83 %, dense stroma in 76.7% and peripheral follicular arrangement in 88.6% (Table 1, Figures 1-4).

Table 1:

US Criteria	Right Ovary	Left Ovary
Volume >10 CC	79%,	75.3%
Follicles >12	81 %	83 %
Dense Stroma	79.4 %	76.7%
Peripheral follicular arrangement	89.8%	88.6%.

Figure 1 : Distribution of unilateral PCO (RO: right ovary, LO: left ovary)

Figure 2: Distribution of sonographic features of PCO in right ovary.

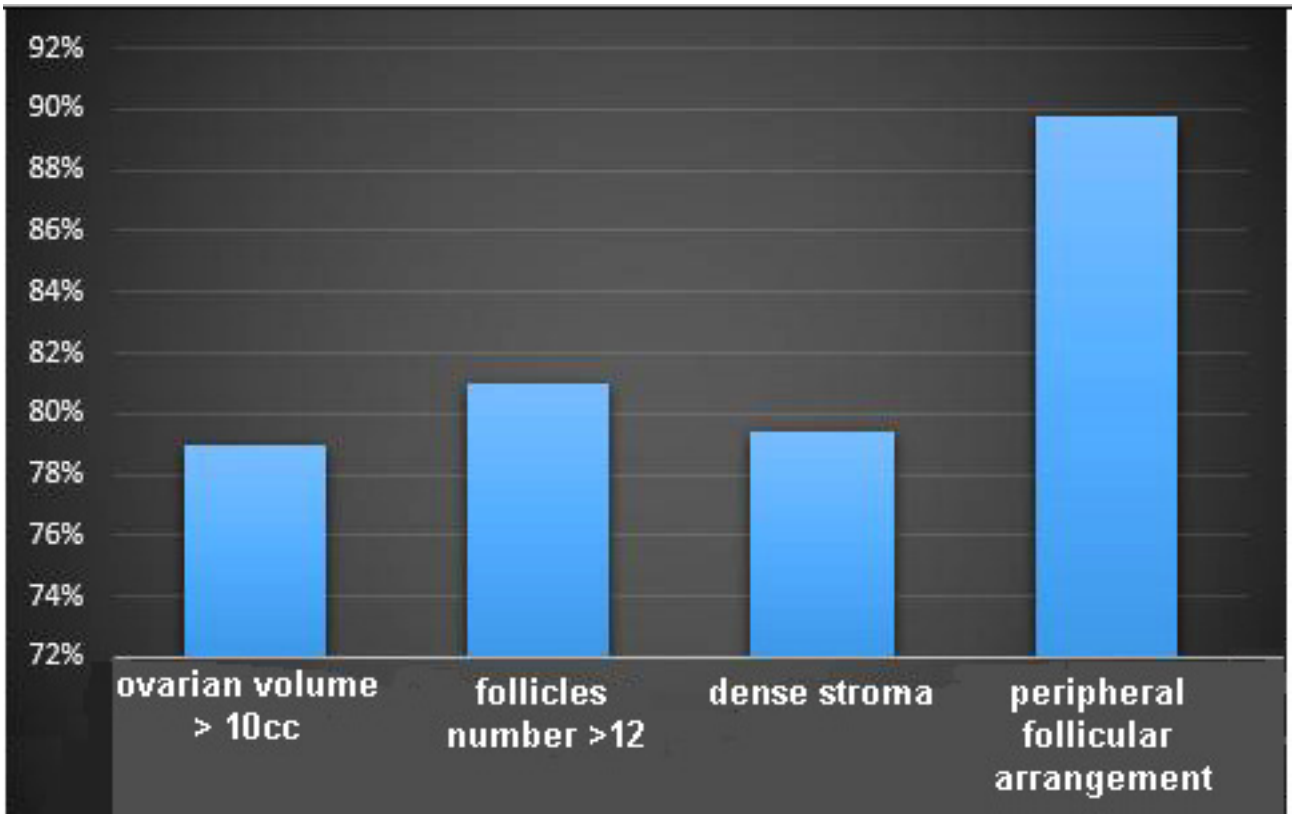


Figure 3: Distribution of sonographic features of PCO in left ovary.

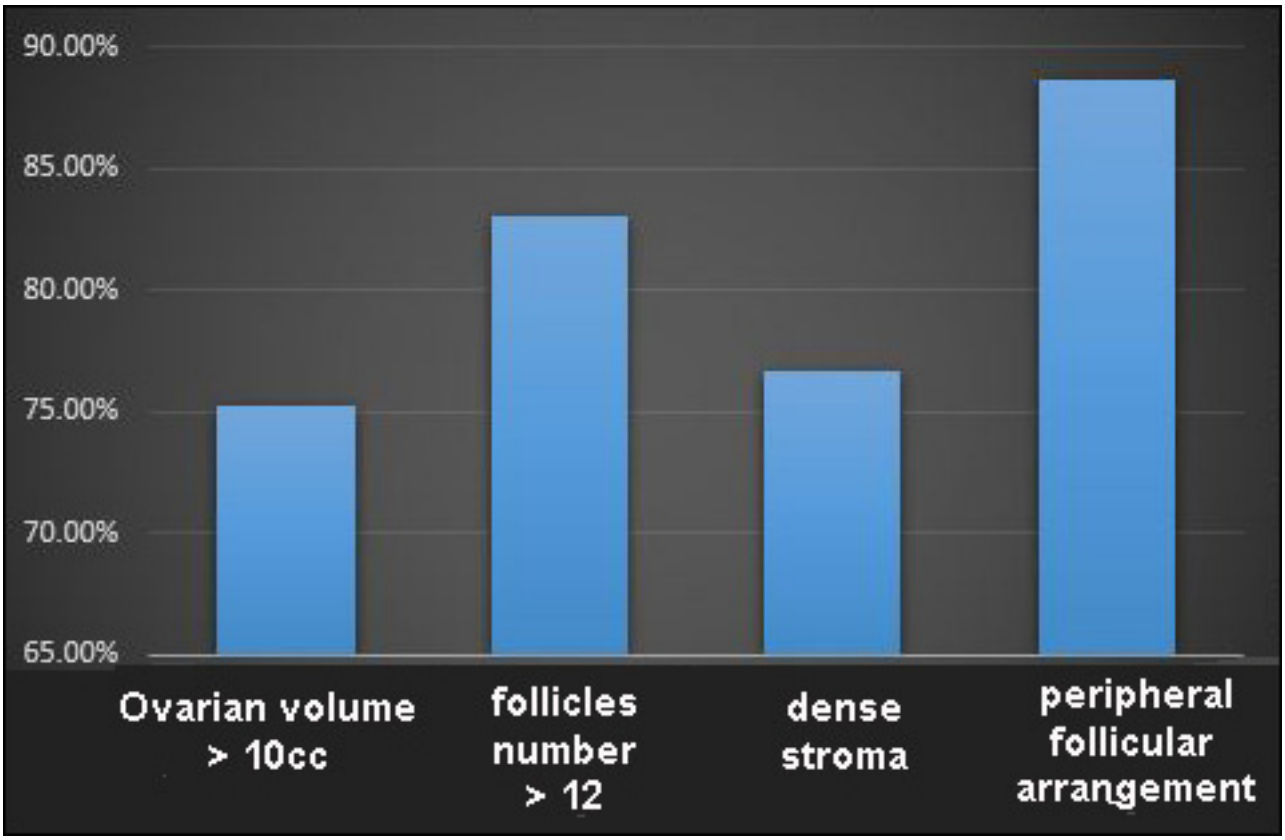
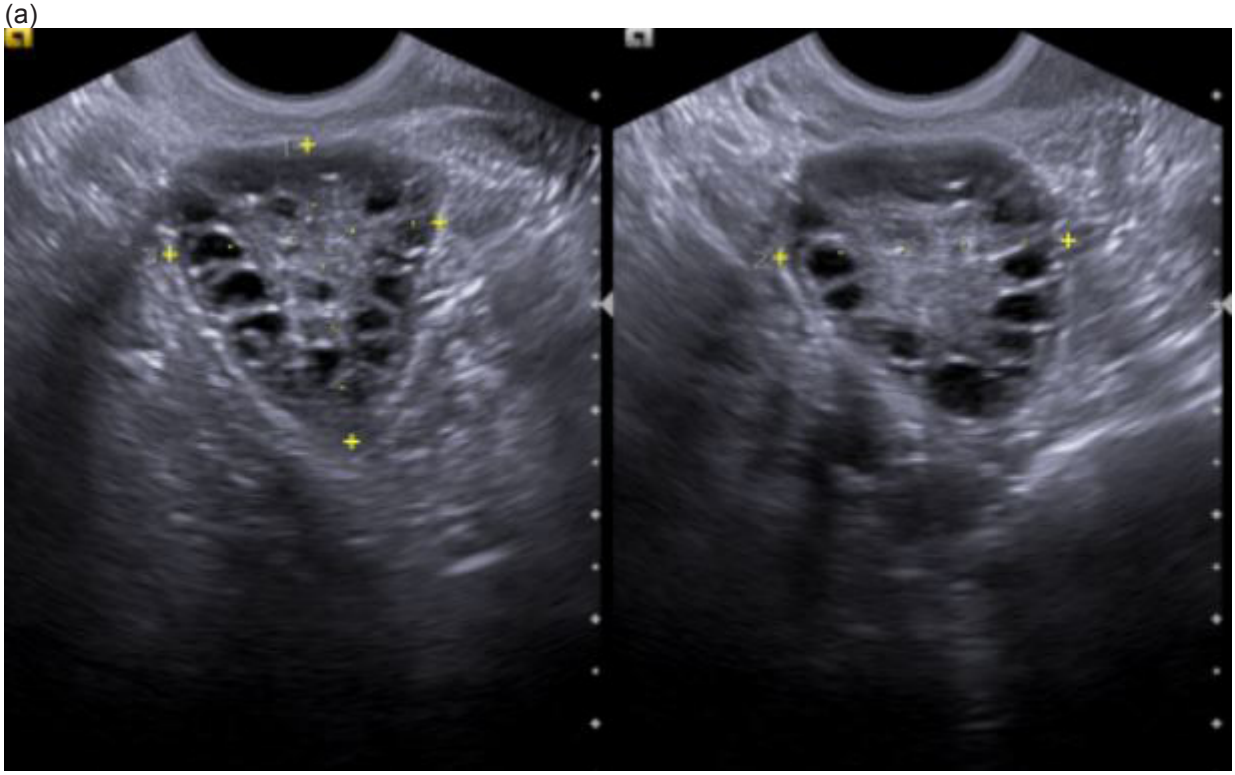
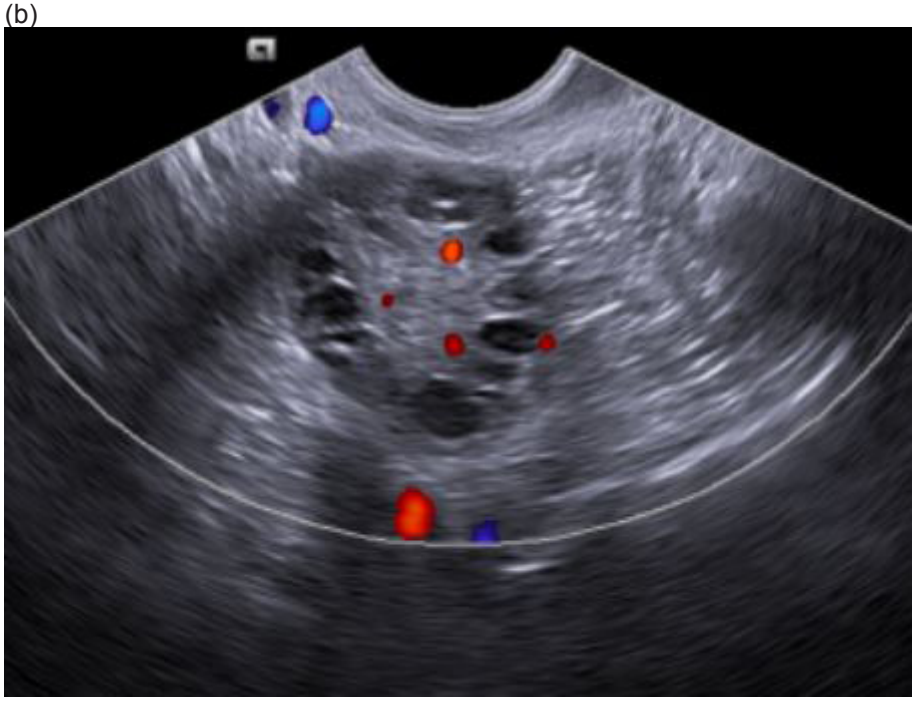


Figure (4): Ultrasound (a) and Doppler (b) of right ovary showing multiple peripheral small cysts with dense stroma.

(a)



(b)



Discussion

PCOS is an extremely common disorder occurring in 4-7% of reproductive age women with a widely variable prevalence among the different countries (range of 2.2% to 26%) as well as greatly depending on the population under assessment reaching 30% in women with secondary amenorrhea, 40% in women with infertility while it can be higher (75%) in cases of oligomenorrhea and can reach up to 90% in cases of hirsutism (1-9).

PCOS is known to be associated with reproductive morbidity and higher risk of endometrial cancer as well as increased risks of metabolic and cardiovascular disorders which is related to insulin resistance as well as an associated link with obesity. Women with PCOS are at higher risk for impaired glucose tolerance, diabetes mellitus type 2, hypertension, and cardiovascular disease, moreover some studies estimated a higher increased risk for myocardial infarction. Many lipid abnormalities are also noted. So early diagnosis of PCOS and close long-term follow-up and screening for diabetes and cardiovascular disease are warranted. Additionally, its therapy can improve the reproductive, metabolic, and cardiovascular risks (1, 4-8).

March et al (19) had conducted a cohort retrospective study for 728 women born during 1973–1975 in a single maternity hospital who were traced and interviewed in adulthood (age 27–34 year s). They described PCO prevalence using the criteria of the National Institutes of Health (NIH) and the advance criteria of Rotterdam and Androgen Excess Society (AES) (20). According to NIH criteria, the PCO prevalence was 8.7 + 2.0%, while the prevalence using the criteria of Rotterdam was 11.9 + 2.4% and increased to 17.8 + 2.8% after the addition of imputed data. The prevalence of PCO was 10.2 + 2.2% according to the AES criteria and increased to 12.0 + 2.4% after adding imputed data.

In another study conducted on Saudi females (29–43 years old), the prevalence was 64.5% in obese and 24.2% in overweight cases (21); in addition it suggested a high preva¬lence of obesity with infertility and PCOS (22-24). Another study conducted in South Australia found a PCO prevalence of 17.8% among 978 women (25) while Lau et al showed the PCOS prevalence of 12% among 100 women based on Rotterdam criteria (26). A higher prevalence of 69% was recorded in Khoury et al's ultrasound study (27) and this causes doubt in the use of ultrasound to diagnose PCOS (28).

Menstrual disorders, especially oligomenorrhea, can be a beginning to ovulatory dysfunction and infertility, and complications due to increased estrogens and androgens in later years, however complications can be reduced by early diagnosis of PCO (29).

The diagnosis of PCOS depends on a combination of one criteria from the following clinical criteria (include: hirsutism (with score of >8 according to the modified Ferriman and Gallwey) (30), menstrual cycle disturbance (irregular; oligo- or amenorrhea), associated with one abnormal bio¬logical criteria (serum LH > 6.5 UI/l, and/or the levels of testosterone >0.7 ng/ml, and/or the levels of androstenedione > 2.2 ng/ml), or unilateral or bilateral volume of ova¬ries higher than 10 cm2 measuring by ultrasound (31,32).

Pelvis ultrasound carries a major role in assessment of ovaries in cases of PCO, the sonographic diagnosis of PCO is demonstration of 12 or more follicles with a diam¬eter of 2-9 mm, or increased ovarian volume > 10 cm3 (at least seen in one ovary).

If a follicle >10 mm is seen, then ultrasound should be repeated later for more accurate volume measurement. Classical sonographic PCO features are the peripheral follicular arrange¬ment in the ovaries (string of pearls appearance) as well as increases ovarian stromal echogenicity (34,35).

It is important to avoid hormonal contraceptives during the ultrasound and hormonal assessment.

In our study, the prevalence of PCO was 6.85%, of which 75.6% was bilateral while 24.4 % was unilateral. Unilateral cases affected right ovary in 64.6 % while left ovary was the only one involved in 35.4%.

Cases with PCO at right ovary showed ovarian volume of more than 10 cc in 79%, follicles number of more than 12 in 81 %, dense stroma in 79.4% and peripheral follicular arrangement in 89.8%

Cases with PCO at left ovary showed ovarian volume of more than 10 cc in 75.3%, follicles number of more than 12 in 83 %, dense stroma in 76.7% and peripheral follicular arrangement in 88.6%

In PCO the growth of small ovarian follicles to become the dominant follicle is not occurring in a normal pat¬tern (36). This is essential in the evaluating of anovulation in PCO, and this was shown to be higher in females with high blood insulin level as well as obese ladies (34).

There may be a misdiagnosis between PCO and other causes of multi-follicular ovaries (MFO) in which only the latest stages of follicular development (>4 mm) are involved. MFO can be seen

in some physiological and pathological conditions such as mid/late normal puberty, central precocious puberty, hypothalamic anovulation, hyperprolactinaemia. This diverted most of authors to assume 10 follicles as a threshold (35,37-38).

Transvaginal ultrasound (TVUS) is superior to transabdominal due to its higher resolution and no need for full urinary bladder as well as a more clear view of the internal structure of the ovaries, avoiding apparently homogeneous ovaries in obesewomen. In addition it is more time saving (39), so transvaginal scan is preferred especially with obese cases (38,41). A probe with >6.5

MHz is used in TVUS to have a good spatial resolution to obtain better results (42).

In another study (35) the prevalence of PCO was high (53.7%) and this was explained by higher incidence of obesity in that community.

Another study calculated stromal index (ratio of mean stromal echogenicity to mean echogenicity of the entire ovary) and total stromal echogenicity (43). There was no difference in the mean stromal echogenicity, however the stromal index in PCO women was significantly higher. The apparent subjective increase in stromal echogenicity in cases of polycystic ovaries as exemplified by the greater stromal index could be attributed to the combination of the increased ovarian stromal volume and significantly lower mean echogenicity of the entire ovary in such case., This reflects low sensitivity of ovarian echogenecity in the diagnosis of PCO.

Limitation of current study

Some cases were virgin, unmarried females thus transvaginal ultrasound could not be done.

Conclusion

The assessment of the ovaries has been greatly improved by sonographic diagnostic criteria of PCO. The diagnostic accuracy in addition to demonstration of ovarian size, can evaluate the characteristic patterns of follicles distribution and ovarian stromal changes. The presence of 12 or more follicles with 2–9 mm diameter is considered a good sensitive indicator moreso than the ovarian volume or ovarian stromal increased echogenicity. Transvaginal ultrasound (TVUS) is considered the gold standard in the diagnosis of PCOS,

Ethical considerations:

The study is approved by PHCC institutional review board research.

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