Is a Routine Ultrasound Scan Necessary for the Diagnosis of Polycystic Ovarian Syndrome?

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Polycystic ovarian syndrome (PCOS) is common among women of reproductive years and patients with this condition may be referred to an endocrinologist, a gynaecologist or a dermatologist, depending on their main presenting complaint. A recently mailed questionnaire to endocrinologists and gynaecologists showed a lack of consensus between the two specialties in the definition, diagnosis and treatment of PCOS. Can routine ultrasound for the imaging of polycystic ovaries be dispensed with? In large measure, the answer is 'yes'. First, polycystic ovaries are common in women without PCOS and not all women with PCOS have polycystic ovaries. Secondly, if the patient has irregular periods and biochemical hyperandrogenism, why scan? Thirdly, the operator dependence of the technique may give false positive and negative scan results. Economically and practically, ultrasound scanning in PCOS should be limited to cases of diagnostic uncertainty performed by a recognized expert in pelvic ultrasonography.

Introduction

Polycystic ovarian syndrome (PCOS) is a common endocrine disorder affecting 6–7% of the population.[1–4] It is characterized by chronic anovulation and hyperandrogenism with the clinical manifestation of oligomenorrhoea, hirsutism and acne.[5] Many women with PCOS may appear to have metabolic syndrome in view of the higher reported incidence of hypertension, dyslipidaemia, visceral obesity, insulin resistance and hyperinsulinaemia in this population.[6] Therefore, appropriate diagnosis and risk stratification is important in this group of patients.

Whether the presence of polycystic ovaries on ultrasound scanning should be used to diagnose polycystic ovarian syndrome routinely, is still debatable. A recent study involving questionnaires to endocrinologists and gynaecologists to compare their clinical practices in the management of patients with PCOS suggested that ovarian ultrasound was requested by almost all gynaecologists (91%), but by less than half of the endocrinologists (44%).[7] This difference in opinion is indicative of the controversies over the inclusion of the ultrasound findings in the diagnostic criteria for PCOS. Polycystic ovaries are a common finding even in women without PCOS.[8–11] In a study where an ultrasound scan was performed in normal volunteer women of reproductive age, of the 158 subjects who were not on oral contraceptives, 23% had polycystic ovaries.[12] Furthermore, the appearance of polycystic ovaries on ultrasound has been shown to have no impact on fertility[13] and neither morphology nor volume of the ovaries is associated with distinctive metabolic or reproductive phenotypes in women with PCOS.[14] In addition, about 10% of women with PCOS do not have polycystic ovaries on ultrasound scanning. A recent study in Germany found polycystic ovaries in only 78% of women in a cohort of 212 PCOS patients previously recruited using the NIH criteria. Nevertheless, it should be noted that some of the studies above were done using the older criteria for polycystic ovaries and relevance of diagnosis made using the new criteria remains to be determined.

The definition of PCOS was first suggested in 1990 from an expert conference sponsored by the National Institutes of Health (NIH). In essence, these criteria define PCOS as a disorder of ovarian androgen excess as characterized by hyperandrogenism and oligo/amenorrhoea after exclusion of disorders that include Cushing's syndrome, congenital adrenal hyperplasia, thyroid dysfunction, hyperprolactinaemia and androgen secreting tumours. However, in 2003, a consensus workshop was held in Rotterdam, sponsored in part by the European Society for Human Reproduction and Embryology and the American Society for Reproductive Medicine where a new criteria was drawn up.[15] According to the Rotterdam criteria, PCOS can be diagnosed if two out of three features are present:

- hyperandrogenism;
- oligo/amenorrhoea;
- polycystic ovaries on ultrasound, after excluding other disorders.

If we look at it closely, the Rotterdam criteria does not replace, but in fact expands the NIH definition of PCOS to include two extra subgroups, i.e. those with polycystic ovaries and hyperandrogenism (with normal regular periods), and those with polycystic ovaries and irregular periods (with no clinical or biochemical evidence of elevated testosterone levels).

What is biochemical hyperandrogenism? Patients with polycystic ovarian syndrome often have a raised serum testosterone above the upper limit of the local assay. Serum testosterone levels more than 7·0 nmol/l raises concerns about alternative diagnoses, such as androgen secreting tumours. However, in addition to the testosterone the sex hormone binding globulin (SHBG) is often requested. The SHBG binds and carries testosterone, and in that form testosterone is inactive; however, the SHBG levels are often lower in PCOS as hyperinsulinaemia (commonly found in PCOS) is associated with a reduction in SHBG. Commonly, the testosterone level is expressed as a relative proportion of the SHBG concentration to derive a 'free androgen index (FAI)' that is a calculated estimate of the amount of 'free' (unbound) testosterone, that may be increased in PCOS when the total testosterone alone is not raised.

Two new phenotypes are proposed by the Rotterdam 2003 criteria for PCOS that is irregular periods without hyperandrogenism, but with polycystic ovaries and secondly regular periods, but with polycystic ovaries and hyperandrogenism. It is not known if these two variants are the same as the most common presentation of irregular periods with

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DOI: 10.1179/174313406X150113

Ultrasound ult1410.3d 25/9/06 14:22:50
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hyperandrogenism. For example, whilst it is unclear if polycystic ovaries confers an increase in insulin resistance.[16–18] the classical phenotype of insulin resistance, hyperandrogenism and menstrual irregularity are associated with an increased risk of type 2 diabetes, but as yet, we do not have data to suggest this in the two new phenotypes suggested.

There are also practical and economic issues involved with including ultrasound scanning routinely in the diagnosis. The variable findings of polycystic ovaries in those with and without the syndrome may, in part, be due to inexpert scanning and varying techniques. It is recognized that, for obese patients, transvaginal scanning is far superior to transabdominal scanning and is the modality of choice. Should a dominant follicle be seen, then it is recommended to bring the patient back at the beginning of the next cycle as this could lead to a false negative scan. However, transvaginal ultrasound scanning does have significant intra- and inter-observer variability, and as such must be considered subjective.[19] Therefore, transvaginal ultrasonography alone may not therefore be a reliable method of diagnosing or excluding PCOS.[20] Economically, in other health care systems outside the UK, ultrasound scanning puts the diagnosis into a higher remuneration band for the practitioner and, therefore, it may be preferable to perform a scan, rather than a routine blood test. Locally, in our UK laboratory, the total cost of a testosterone is approximately £7 and the cost of a sex hormone binding globulin £9: venesection can be done within minutes at the point of contact at the initial consultation and minimal expertise to perform it and the samples are measured by automated systems. Conversely, the cost of a transvaginal ultrasound is £32, requires an additional expert professional and often has an inherent wait for an appointment in another location.

In conclusion, polycystic ovaries on ultrasound are found commonly in 20% of normal women, whereas 10% of those with polycystic ovarian syndrome (defined by NIH criteria) do not have polycystic ovaries on ultrasound. The combination of irregular periods with a raised testosterone or FAI makes an ultrasound examination unnecessary in the majority of women and should be reserved for cases of uncertainty or research. In these days of financial constraint and the strain on diagnostic services through increased demand, the routine use of ultrasound in the diagnosis of PCOS, in these authors' opinion, is limited.

References

1. Knochenhauer ES, Key TJ, Kahsar-Miller M, Waggoner W, Boots LR, Azziz R Prevalence of the polycystic ovaries syndrome in unselected black and white women of the southeastern United States: a prospective study. J Clin Endocrinol Metab 1998;83:3078–3082.
2. Diamanti-Kandarakis E, Kouli CR, Bergiele AT, *et al.* A survey of the polycystic ovaries syndrome in the Greek island of Lesbos: hormonal and metabolic profile. J Clin Endocrinol Metab 1999;84:4006–4011.
3. Asuncion M, Calvo RM, San Millan JL, Sancho J, Avila S, Escobar-Morreale HF. A prospective study of the prevalence of the polycystic ovaries syndrome in unselected Caucasian women from Spain. J Clin Endocrinol Metab 2000;85:2434–438.
4. Azziz R, Woods KS, Reyna R, Key TJ, Knochenhauer ES, Yildiz BO. The prevalence and features of the polycystic ovaries syndrome in an unselected population. J Clin Endocrinol Metab 2004;89:2745–2749.
5. Franks S. Polycystic ovaries syndrome. N Engl J Med 1995;333:853–861.
6. Glueck CJ, Papanna R, Wang P, Goldenberg N, Sieve-Smith L. Incidence and treatment of metabolic syndrome in newly referred women with confirmed polycystic ovarian syndrome. Metabolism 2003;52:908–915.
7. Cussons AJ, Stuckey BG, Walsh JP, Burke V, Norman RJ Polycystic ovarian syndrome: marked differences between endocrinologists and gynaecologists in diagnosis and management. Clin Endocrinol (Oxf) 2005;62:289–295.
8. Clayton RN, Ogden V, Hodgkinson J, *et al.* How common are polycystic ovaries in normal women and what is their significance for the fertility of the population? Clin Endocrinol (Oxf) 1992;37:127–134.
9. Botsis D, Kassanos D, Pyrgiotis E, Zourlas PA. Sonographic incidence of polycystic ovaries in a gynecological population. Ultrasound Obstet Gynecol 1995;6:182–185.
10. Cresswell JL, Barker DJ, Osmond C, Egger P, Phillips DI, Fraser RB Fetal growth, length of gestation, and polycystic ovaries in adult life. Lancet 1997;350:1131–1135.
11. Kousta E, White DM, Cela E, McCarthy MI, Franks S. The prevalence of polycystic ovaries in women with infertility. Hum Reprod 1999;14:2720–2723
12. Polson DW, Adams J, Wadsworth J, Franks S Polycystic ovaries—a common finding in normal women. Lancet 1988;1:870–872.
13. Hassan MA, Killick SR. Ultrasound diagnosis of polycystic ovaries in women who have no symptoms of polycystic ovaries syndrome is not associated with subfecundity or subfertility. Fertil Steril 2003;80:966–975.
14. Legro RS, Chiu P, Kunselman AR, Bentley CM, Dodson WC, Dunaif A Polycystic ovaries are common in women with hyperandrogenic chronic anovulation but do not predict metabolic or reproductive phenotype. J Clin Endocrinol Metab 2005;90:2571–2579.
15. Group REA-SPCW Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovaries syndrome. Fertil Steril 2004;81:19–25.
16. Michelmore K, Ong K, Mason S, *et al.* Clinical features in women with polycystic ovaries: relationships to insulin sensitivity, insulin gene VNTR and birth weight. Clin Endocrinol (Oxf) 2001;55:439–446.
17. Adams JM, Taylor AE, Crowley WF, Jr, Hall JE Polycystic ovarian morphology with regular ovulatory cycles: insights into the pathophysiology of polycystic ovarian syndrome. J Clin Endocrinol Metab 2004;89:4343–4350.
18. Raskauskiene D, Jones PW, Govind A, Obhrai M, Clayton RN Do polycystic ovaries on ultrasound scan indicate decreased insulin sensitivity in sisters of women with polycystic ovaries syndrome? J Clin Endocrinol Metab 2005;90:2063–2067.
19. Hahn S, Bering van Halteren W, Roesler S, *et al.* The combination of increased ovarian volume and follicle number is associated with more severe hyperandrogenism in German women with polycystic ovaries syndrome. Exp Clin Endocrinol Diabetes 2006;114:175–181.
20. Amer SA, Li TC, Bygrave C, Sprigg A, Saravelos H, Cooke ID. An evaluation of the inter-observer and intra-observer variability of the ultrasound diagnosis of polycystic ovaries. Hum Reprod 2002;17:1616–1622.

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