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POLYCYSTIC OVARY SYNDROME: DIAGNOSTIC CRITERIA AND TREATMENT METHODS

Abstract

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age, characterized by marked clinical heterogeneity, phenotypic variability, and a high risk of metabolic and reproductive complications. The condition has a multifactorial etiology and a complex pathogenesis, including disturbances in neuroendocrine regulation, insulin resistance, and hyperandrogenism, which result in a wide spectrum of clinical manifestations and complicate timely diagnosis.

The article summarizes current scientific data on the diagnostic criteria and treatment approaches for PCOS in accordance with international guidelines from 2018–2023. The role of the Rotterdam criteria as the basis for diagnosis is highlighted, as well as the особеності of their application across different age groups, particularly in adolescents, taking into account the risks of overdiagnosis and underdiagnosis. Special attention is paid to the role of anti-Müllerian hormone as a potential adjunctive biomarker of polycystic ovarian morphology, as well as to the limitations of its clinical use associated with variability in measurements and the lack of standardized reference values. Key pathogenetic mechanisms of the disease are analyzed, including insulin resistance, hyperandrogenism, dysfunction of the hypothalamic–pituitary–ovarian axis, and their relationship

with metabolic changes. Modern therapeutic strategies based on a multidisciplinary and individualized approach are considered, including lifestyle modification, the use of combined oral contraceptives, insulin-sensitizing agents, inositols, and fertility restoration methods, including ovulation induction. The importance of early diagnosis, comprehensive assessment of cardiometabolic risks, long-term monitoring, and personalized management of patients with PCOS is emphasized in order to improve quality of life, preserve reproductive health, and prevent long-term complications.

Keywords: polycystic ovary syndrome, diagnosis, hyperandrogenism, insulin resistance, Rotterdam criteria, treatment.

Problem statement. Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age, affecting 8–13% of the population and remaining undiagnosed in more than 70% of cases. It is characterized by significant clinical heterogeneity and diagnostic complexity. Despite the availability of internationally recognized diagnostic criteria, particularly the Rotterdam criteria, the problem of timely diagnosis remains relevant due to the absence of a single pathognomonic marker and the considerable variability of clinical manifestations [1-4].

Particular difficulties arise in diagnosing PCOS in adolescents, as the physiological features of puberty may mimic the symptoms of the disorder, increasing the risk of both overdiagnosis and underdiagnosis. In addition, current evidence indicates the multisystem nature of PCOS, which affects not only the reproductive system but also metabolic, endocrine, and psycho-emotional domains.

Another important issue is the lack of standardized approaches to the use of novel biomarkers, particularly anti-Müllerian hormone, which limits their widespread implementation in clinical practice. At the same time, the significance

of metabolic disturbances, including insulin resistance and increased cardiovascular risk, is growing, necessitating early detection and comprehensive management of patients [5].

Thus, the need to improve diagnostic approaches, individualize therapy, and prevent long-term complications determines the relevance of further research in this field.

Analysis of recent research and publications. Recent scientific studies confirm that PCOS is a heterogeneous multisystem disorder, the diagnosis of which is based on the Rotterdam criteria, taking into account updated international guidelines from 2018 and 2023 [4, 6–7]. Considerable attention has been paid to the role of anti-Müllerian hormone (AMH) as a potential biomarker of polycystic ovarian morphology. It has been established that AMH levels are elevated in women with PCOS and correlate with the number of antral follicles; however, its use is limited by the lack of standardized cut-off values and significant variability in measurements [14, 16].

Recent studies also emphasize the systemic nature of PCOS, particularly its association with insulin resistance, obesity, and increased cardiometabolic risk [5, 11]. In the field of treatment, there is a shift toward personalized approaches that take into account disease phenotype, reproductive plans, and associated metabolic disorders [7].

Purpose of the article. To summarize current scientific data on the diagnostic criteria of polycystic ovary syndrome and to analyze contemporary approaches to its treatment.

Presentation of the main material of the study. An analytical review of contemporary scientific sources was conducted, including international clinical guidelines, systematic reviews, meta-analyses, and clinical studies published in PubMed, Scopus, and Web of Science databases.

The pathogenesis of PCOS includes dysfunction of the hypothalamic-pituitary-ovarian axis, increased secretion of gonadotropin-releasing hormone, altered ratios of luteinizing and follicle-stimulating hormones, hyperandrogenism, and insulin resistance. These mechanisms lead to impaired folliculogenesis, chronic anovulation, and the development of polycystic ovarian morphology [3].

Modern diagnosis of polycystic ovary syndrome (PCOS) is based on the Rotterdam criteria (2003), which have been confirmed and refined by international guidelines of 2018 and 2023. According to them, the diagnosis is established in the presence of two out of three features: hyperandrogenism (clinical or biochemical), ovulatory dysfunction, and ultrasound signs of polycystic ovarian morphology. An important condition is the exclusion of other endocrine disorders [4, 6–7].

Hyperandrogenism is a key component of PCOS and is observed in most patients. It may manifest clinically (hirsutism, acne, androgenic alopecia) or laboratorily (increased levels of testosterone, free androgen index). The most informative laboratory indicators are considered to be free testosterone and the free androgen index, which have high sensitivity and specificity [8].

Ovulatory dysfunction manifests as oligo- or amenorrhea, which is the result of chronic anovulation. The criteria for menstrual cycle disturbances vary depending on age and time since menarche, which is especially important in the diagnosis in adolescents [7].

An equally important diagnostic component is the assessment of menstrual function, which reflects the state of the hypothalamic-pituitary-ovarian axis. It has been established that the regularity and duration of the menstrual cycle depend on many factors, including body weight, level of physical activity, nutrition, presence of stress, harmful habits, and concomitant endocrine or somatic diseases. In clinical practice, oligomenorrhea is usually defined as a cycle duration of more than 35 days; however, modern approaches provide for a differentiated assessment

depending on age and gynecological age. Thus, during the first 1–3 years after menarche, cycle variability may be physiological, and cycles lasting <21 or >45 days are considered pathological. After three years from menarche, the criteria for нарушения are intervals <21 or >35 days, fewer than 8 menstrual cycles per year, as well as intervals of more than 90 days between menstruations. Primary amenorrhea should also be taken into account - absence of menarche by the age of 15 or within three years after thelarche. Such an approach emphasizes the need for an individualized assessment of menstrual function taking into account age-related characteristics, which is of key importance for avoiding both underdiagnosis and overdiagnosis of PCOS [2].

Ultrasound examination of the pelvic organs is an important auxiliary method in the diagnosis of PCOS; however, its role should be considered in combination with clinical and laboratory data. Detection of polycystic ovarian morphology alone is not sufficient to establish the diagnosis. According to the updated 2023 recommendations, the presence of ≥20 antral follicles in one ovary or increased ovarian volume is considered diagnostically significant. Additionally, stromal echogenicity, the pattern of follicle distribution (peripheral or diffuse), the total number of antral follicles, as well as blood flow parameters in the ovarian and uterine arteries are evaluated. At the same time, it should be taken into account that ultrasound features have limited specificity, especially in adolescents, in whom multifollicular ovarian structure is often a variant of age-related norm. This determines the risk of overdiagnosis and emphasizes the need for careful interpretation of results taking into account the clinical context and the patient’s age [7].

In recent years, considerable attention has been paid to the role of anti-Mullerian hormone (AMH) as a potential alternative or additional biomarker in the diagnosis of polycystic ovary syndrome. AMH is synthesized by granulosa cells of preantral and small antral follicles and reflects ovarian reserve and the functional

activity of the ovaries. In women with PCOS, its level is usually elevated, which is обусловлено by an increased number of antral follicles and increased hormone production by each follicle [7, 16].

An elevated level of AMH correlates with characteristic morphological changes of the ovaries and may be considered an indirect marker of polycystic ovarian morphology, especially in cases where ultrasound examination is limited or insufficiently informative. Threshold AMH values in the range of 3.8–5.0 ng/mL have been proposed as potentially diagnostically significant; however, they vary considerably depending on age, assay method, and population characteristics [14].

At the same time, despite the high sensitivity of AMH, its specificity remains limited, as there is a significant overlap of values between healthy women and patients with PCOS. This is especially true for adolescents, in whom the number of antral follicles is physiologically increased and, accordingly, AMH levels are higher, which significantly reduces its diagnostic value in this age group [7, 15–16].

Current international guidelines (2023) allow the use of AMH as an alternative criterion for determining polycystic ovarian morphology in adult women in the absence of ultrasound data; however, they do not recommend using this indicator as an independent diagnostic criterion. In addition, in the presence of clinical hyperandrogenism and ovulatory dysfunction, AMH determination is not mandatory for establishing the diagnosis of PCOS [7].

Thus, AMH is considered a promising but auxiliary marker that may increase diagnostic accuracy in complex clinical cases, but requires further standardization of measurement methods and unification of reference values.

PCOS is not only a gynecological but also a multisystem pathology that encompasses metabolic, endocrine, and cardiovascular disorders. One of the key pathogenetic mechanisms is insulin resistance, which is detected in the majority of

patients regardless of body mass index and plays a leading role in disease development. As a result of decreased tissue sensitivity to insulin, compensatory hyperinsulinemia develops, which stimulates the androgen-producing function of ovarian theca cells and simultaneously suppresses the synthesis of sex hormone-binding globulin (SHBG) in the liver. This leads to an increase in free androgen levels and enhancement of the clinical manifestations of hyperandrogenism. In addition, insulin potentiates the action of luteinizing hormone, which further activates steroidogenesis in the ovaries. Thus, a vicious pathogenetic cycle is formed, which maintains hormonal imbalance and progression of PCOS [7, 11].

Metabolic complications of PCOS include an increased risk of developing type 2 diabetes mellitus, dyslipidemia, and cardiovascular diseases. It has been proven that women with the hyperandrogenic phenotype have a significantly higher risk of diabetes compared to other phenotypes. An increased frequency of arterial hypertension and atherosclerotic changes is also noted [11].

Particular attention is drawn to psycho-emotional disorders, which significantly reduce the quality of life of patients. Depression, anxiety disorders, and impaired self-esteem are associated both with hormonal changes and with clinical manifestations (obesity, hirsutism, infertility).

Modern approaches to the treatment of polycystic ovary syndrome are based on a multidisciplinary and individualized strategy that takes into account the phenotype of the disease, the metabolic profile, and the reproductive plans of the patient. According to international recommendations, therapy should be aimed not only at eliminating clinical manifestations, but also at preventing long-term cardiometabolic complications [4, 7].

The basis of treatment is lifestyle modification, which includes normalization of body weight, increasing the level of physical activity, and rationalization of nutrition. It has been established that even a moderate reduction in body weight by 5–10% is associated with a significant improvement in insulin

sensitivity, restoration of ovulation, and normalization of the menstrual cycle, as well as a decrease in androgen levels [4–5, 7]. Physical activity of moderate intensity (at least 150 minutes per week) has a positive effect on metabolic parameters, including lipid profile and glycemic control [7].

Pharmacotherapy of PCOS is determined by the clinical manifestations of the disease and the reproductive intentions of the woman. In patients who are not planning pregnancy, first-line drugs are combined oral contraceptives (COCs), which provide regulation of the menstrual cycle and reduction of manifestations of hyperandrogenism [7]. Their mechanism of action consists in suppressing the secretion of gonadotropins, reducing ovarian androgen production, and increasing the level of sex hormone-binding globulin (SHBG), which leads to a decrease in androgen bioavailability [4].

Additionally, COCs contribute to the reduction of clinical manifestations of hyperandrogenism, such as acne and hirsutism, and have a preventive effect on the development of endometrial hyperplasia as a result of chronic anovulation [5]. The choice of a specific drug should be made taking into account individual risk factors, including metabolic disorders, obesity, and cardiovascular risk.

Metformin is widely used for the correction of insulin resistance, especially in patients with obesity or impaired glucose tolerance. It improves tissue sensitivity to insulin, contributes to normalization of the menstrual cycle, and may increase the frequency of ovulation [10].

Inositols (myo-inositol, D-chiro-inositol) are considered promising agents for the correction of metabolic and hormonal disorders. They improve insulin sensitivity and have a favorable safety profile [9–10].

For the treatment of infertility in women with PCOS, ovulation induction methods are widely used. According to current international recommendations, letrozole is the first-line drug, as it demonstrates higher effectiveness in achieving ovulation and live birth compared to clomiphene citrate. The latter, despite its

long-term use in clinical practice, is gradually losing its position as a first-line agent. In cases of resistance to pharmacological ovulation induction, gonadotropins or assisted reproductive technologies, including in vitro fertilization, are used [7, 12–13].

The updated 2023 recommendations emphasize the individualization of treatment, assessment of cardiometabolic risks, the psycho-emotional state of patients, and improvement of quality of life. Patient involvement in decision-making and a multidisciplinary approach are important [7].

Conclusions. Polycystic ovary syndrome is a complex multifactorial disease with diverse clinical manifestations and significant long-term risks. Modern diagnostic approaches are based on a combination of clinical, laboratory, and instrumental criteria with mandatory exclusion of other pathologies.

Treatment of PCOS should be individualized and aimed not only at eliminating symptoms but also at preventing metabolic and cardiovascular complications. The basis of therapy is lifestyle modification, supplemented by pharmacological treatment according to the clinical situation.

Further research is needed to improve diagnostic algorithms, standardize biomarkers, and optimize therapeutic strategies, which will contribute to improving the quality of medical care for women with PCOS.

References

1. Bozdag, G., Mumusoglu, S., Zengin, D., Karabulut, E., & Yildiz, B. O. (2016). The prevalence and phenotypic features of polycystic ovary syndrome: a systematic review and meta-analysis. *Human reproduction (Oxford, England), 31*(12), 2841–2855. https://doi.org/10.1093/humrep/dew218

2. Peña, A. S., Witchel, S. F., Hoeger, K. M., Oberfield, S. E., Vogiatzi, M. G., Misso, M., Garad, R., Dabadghao, P., & Teede, H. (2020). Adolescent pol-

ycystic ovary syndrome according to the international evidence-based guideline. *BMC medicine*, *18*(1), 72. https://doi.org/10.1186/s12916-020-01516-x

3. Ibáñez, L., Oberfield, S. E., Witchel, S., Auchus, R. J., Chang, R. J., Codner, E., Dabadghao, P., Darendeliler, F., Elbarbary, N. S., Gambineri, A., Garcia Rudaz, C., Hoeger, K. M., López-Bermejo, A., Ong, K., Peña, A. S., Reinehr, T., Santoro, N., Tena-Sempere, M., Tao, R., Yildiz, B. O., … Lee, P. A. (2017). An International Consortium Update: Pathophysiology, Diagnosis, and Treatment of Polycystic Ovarian Syndrome in Adolescence. *Hormone research in paediatrics*, *88*(6), 371–395. https://doi.org/10.1159/000479371

4. Teede, H. J., Misso, M. L., Costello, M. F., Dokras, A., Laven, J., Moran, L., Piltonen, T., Norman, R. J., & International PCOS Network (2018). Recommendations from the international evidence-based guideline for the assessment and management of polycystic ovary syndrome. *Human reproduction (Oxford, England)*, *33*(9), 1602–1618. https://doi.org/10.1093/humrep/dey256

5. Sadeghi, H. M., Adeli, I., Calina, D., Docea, A. O., Mousavi, T., Daniali, M., Nikfar, S., Tsatsakis, A., & Abdollahi, M. (2022). Polycystic Ovary Syndrome: A Comprehensive Review of Pathogenesis, Management, and Drug Repurposing. *International journal of molecular sciences*, *23*(2), 583. https://doi.org/10.3390/ijms23020583

6. Rotterdam ESHRE/ASRM-Sponsored PCOS consensus workshop group (2004). Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). *Human reproduction (Oxford, England)*, *19*(1), 41–47. https://doi.org/10.1093/humrep/deh098

7. Teede, H. J., Tay, C. T., Laven, J. J. E., Dokras, A., Moran, L. J., Piltonen, T. T., Costello, M. F., Boivin, J., Redman, L. M., Boyle, J. A., Norman, R. J., Mousa, A., & Joham, A. E. (2023). Recommendations From the 2023 International Evidence-based Guideline for the Assessment and Management of Polycys-

tic Ovary Syndrome. *The Journal of clinical endocrinology and metabolism*, *108*(10), 2447–2469. https://doi.org/10.1210/clinem/dgad463

8. Joham, A. E., Norman, R. J., Stener-Victorin, E., Legro, R. S., Franks, S., Moran, L. J., Boyle, J., & Teede, H. J. (2022). Polycystic ovary syndrome. *The Lancet Diabetes and Endocrinology*, *10*(9), 668-680. https://doi.org/10.1016/S2213-8587(22)00163-2

9. Pundir, J., Psaroudakis, D., Savnur, P., Bhide, P., Sabatini, L., Teede, H., Coomarasamy, A., & Thangaratinam, S. (2018). Inositol treatment of anovulation in women with polycystic ovary syndrome: a meta-analysis of randomised trials. *BJOG: an international journal of obstetrics and gynaecology*, *125*(3), 299–308. https://doi.org/10.1111/1471-0528.14754

10. Morley, L. C., Tang, T., Yasmin, E., Norman, R. J., & Balen, A. H. (2017). Insulin-sensitising drugs (metformin, rosiglitazone, pioglitazone, D-chiro-inositol) for women with polycystic ovary syndrome, oligo amenorrhoea and subfertility. *The Cochrane database of systematic reviews*, *11*(11), CD003053. https://doi.org/10.1002/14651858.CD003053.pub6

11. Siddiqui, S., Mateen, S., Ahmad, R., & Moin, S. (2022). A brief insight into the etiology, genetics, and immunology of polycystic ovarian syndrome (PCOS). *Journal of assisted reproduction and genetics*, *39*(11), 2439–2473. https://doi.org/10.1007/s10815-022-02625-7

12. Mahoney, A., & D'Angelo, A. (2025). Treatment Options for Managing Anovulation in Women with PCOS: An Extensive Literature Review of Evidence-Based Recommendations for Future Directions. *Life (Basel, Switzerland)*, *15*(6), 863. https://doi.org/10.3390/life15060863

13. Wasim, T., Nasrin, T., Zunair, J., & Irshad, S. (2024). Efficacy of Letrozole vs Clomiphene Citrate for induction of ovulation in women with polycystic ovarian syndrome. *Pakistan journal of medical sciences*, *40*(1Part-I), 78–83. https://doi.org/10.12669/pjms.40.1.7971

14. Butt, M. S., Saleem, J., Aiman, S., Zakar, R., Sadique, I., & Fischer, F. (2022). Serum anti-Müllerian hormone as a predictor of polycystic ovarian syndrome among women of reproductive age. *BMC women's health*, *22*(1), 199. https://doi.org/10.1186/s12905-022-01782-2

15. Sergiyenko, M.Yu., Siusiuka, V.G., Makurina, G.I., Deinichenko, O.V., Kolokot, N.G., Chornenka A.S. (2022). Modern approaches to the diagnosis and treatment of polycystic ovary syndrome in adolescence. *Reproductive health of woman*, *2* (57), 73-78. https://doi.org/10.30841/2708-8731.2.2022.261816

16. Dumont, A., Robin, G., Catteau-Jonard, S., & Dewailly, D. (2015). Role of Anti-Müllerian Hormone in pathophysiology, diagnosis and treatment of Polycystic Ovary Syndrome: a review. *Reproductive biology and endocrinology: RB&E*, *13*, 137. https://doi.org/10.1186/s12958-015-0134-9