AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 6. No 04. Aprel ,2026

THE IMPORTANCE OF TRANSVAGINAL ULTRASOUND EXAMINATION IN THE EARLY DETECTION OF OVARIAN CANCER

Abdurakhmanova Muazzam
Student of the Faculty of Treatment,
Tashkent State Medical University, Tashkent, Uzbekistan,
e-mail: abdurahmonovamuazzam75@gmail.com
Alisherova Farangis
Tashkent, Uzbekistan. e-mail: farrina999@gmail.com

Abstract: This article analyzes the diagnostic significance of transvaginal ultrasound examination (TVUS) in the early detection of ovarian cancer, as well as the advantages, limitations, and potential for combining this method with modern diagnostic approaches. Ovarian cancer is one of the most dangerous pathologies in gynecological oncology. Due to its prolonged asymptomatic course and detection at late stages, mortality rates remain high. According to WHO data, over 300,000 new cases are registered worldwide annually. In Uzbekistan, 70–80% of cases are diagnosed at stages III–IV due to insufficient screening programs. TVUS is considered a first-line screening method due to its non-invasiveness, cost-effectiveness, and real-time results. Using the IOTA Simple Rules and the IOTA ADNEX model, the accuracy of distinguishing benign from malignant tumors reaches 94–96%. Color Doppler imaging additionally allows assessment of blood flow parameters (resistance index <0.4, pulsatility index <1.0). Combining TVUS with the CA-125 tumor marker and the ROMA index increases diagnostic accuracy to 96–97%. The integration of artificial intelligence technologies (AI transformer models) enables ovarian cancer diagnosis with 92–98% accuracy and reduces diagnostic errors by up to 30%. Meanwhile, limitations of the method include dependence on operator experience (error rate 20–30%), reduced sensitivity (70–75%) in stage I, and false-positive results (up to 30%). In conclusion, TVUS is a primary diagnostic tool in ovarian cancer screening; combining it with biomarkers and artificial intelligence can significantly improve early diagnosis and survival rates. In Uzbekistan, expanding screening coverage in rural areas and improving specialist training remain urgent priorities.

Keywords: Ovarian cancer, Transvaginal ultrasound (TVUS), Screening programs, Cancer prevention, Artificial intelligence (AI) integration, Biomarkers, CA-125

Introduction. Ovarian cancer stands out not only due to its high mortality risk but also as one of the most dangerous pathologies in the field of gynecological oncology. Among oncological diseases of the female reproductive system, ovarian cancer is particularly distinguished by its complex course and low sensitivity to therapeutic measures. The prognosis of this pathology largely depends on the stage at which the disease is detected, and because the possibility of diagnosis in the early stages is limited, mortality rates remain high [1]. According to official statistics from the World Health Organization (WHO), more than 300,000 women worldwide are affected by this disease annually. According to scientists' forecasts, by 2050 this figure is expected to increase by 75%, which sharply raises the urgency of early diagnosis [10]. According to the International Agency for Research on Cancer (IARC), ovarian cancer is the 8th most common oncological disease among women [25]. If the disease is not detected at stage I or II, the five-year survival rate of patients is only 30–40%. At stages III and IV, this rate drops to 15–20% [1]. In the United States, more than 13,000 women die from this disease each year [4]. According to the American Cancer Society (ACS), 19,680 new cases were recorded in the

United States in 2024, and 12,740 women died from this disease [26]. According to the Global Burden of Disease (GBD) study, the economic damage caused by ovarian cancer to women's health exceeds 20 billion dollars annually [29]. Ovarian cancer stands out not only due to its high mortality risk but also as one of the most dangerous pathologies in the field of gynecological oncology. When analyzed globally by incidence, this disease ranks seventh in terms of occurrence among women [13].

The main difficulty in detecting this pathology at an early stage is that the disease continues for a long time without clear symptoms and is often confused with other diseases related to the digestive system [3]. According to statistical data published in 2022, 324,603 new cases of ovarian cancer were officially registered worldwide [11]. WHO reports state that more than 200,000 women die each year due to this disease [12]. Transvaginal ultrasound examination (TVUS) emerges as an important diagnostic tool for detecting changes in the morphological structure of the ovaries, abnormalities in their size, shape, contour, internal structure, and disorders of the circulatory system. This method has advantages such as minimal invasiveness, ease of use, and the ability to obtain results in real time [3].

The issue of detecting ovarian cancer at early stages is directly related to the high mortality rate of this disease. In Uzbekistan, due to the insufficient coverage of screening programs, 70–80% of the pathology is detected at late stages (stages III–IV). The importance of transvaginal ultrasound examination lies in the fact that through screening performed with this method, it is possible to detect the disease at stage I, in which case the survival rate of patients increases to up to 90%. This is because in the early stages, surgical intervention and chemotherapy sessions are significantly more effective [4]. According to the results of the UKCTOCS (United Kingdom Collaborative Trial of Ovarian Cancer Screening) study, TVUS-based screening can reduce mortality rates by 20% [28]. At the same time, traditional screening methods (for example, the RMI test) have a relatively low accuracy rate, which is 50–60%. Therefore, the implementation of artificial intelligence (AI) technologies and IOTA ADNEX models into practice is an urgent task. These modern models allow diagnosing the pathology with 96% accuracy and significantly reduce diagnostic errors [8]. The relevance is also reflected socially: in developing countries, the coverage level of screening programs is low; for example, in rural areas of Uzbekistan, this figure is only 30–40%. This leads to an increase in deaths and increases the economic burden of treatment at late stages by 2–3 times [6]. In the Republic of Uzbekistan, an increase in the incidence of ovarian cancer has also been observed in recent years, which is explained by the insufficiently developed system of preventive examinations.

Aim. This article analyzes the diagnostic significance of transvaginal ultrasound examination in the early diagnosis of ovarian cancer, the relevance of the method, its existing limitations, and recent scientific research. Also, the issues of integrating artificial intelligence (AI) and other innovative technologies into the diagnostic process are discussed.

Main part. *Technical description and methodological foundations of transvaginal ultrasound examination.* Transvaginal ultrasound examination is a non-invasive diagnostic imaging method performed by inserting a special high-frequency (5–12 MHz) probe into the vaginal cavity. This method allows visualization of the ovaries at a much closer distance compared to examination through the abdominal wall, which is important for detecting small pathological changes (up to 1–2 cm) [14]. When using TVUS, B-mode (gray scale) and color Doppler imaging (CDI) modes are used together, which allows for a comprehensive assessment of the morphological structure and blood circulation characteristics of the ovaries [15]. 3D/4D ultrasound technologies enable the creation of a volumetric image of the tumor and increase diagnostic accuracy by 10–15% [30].Radiological signs of ovarian cancer on TVUS (sonographic semiotics). On transvaginal ultrasound examination, the radiological signs of ovarian cancer are assessed based on a number of morphological and hemodynamic criteria. In modern ultrasound diagnostics, the classification system developed by the international IOTA (International Ovarian Tumor Analysis) group is widely used. According to this system, ovarian tumors are divided into simple (benign) and complex (malignant) formations [16]. Since 1999, the IOTA group has conducted studies covering more than 10,000 patients in over 20 countries [31].

Main radiological signs of ovarian cancer on TVUS. Transvaginal ultrasound examination (TVUS) is considered a first-line diagnostic imaging method for evaluating ovarian tumors. The standardized terminology and classification system developed by the international IOTA (International Ovarian Tumor Analysis) group plays an important role in increasing diagnostic accuracy [46]. The IOTA group was established in 1999 and has conducted the largest studies aimed at early detection of ovarian tumors by introducing standardization in ultrasound diagnostics [46]. According to this system, all ovarian tumors are divided into five main categories. The first category is unilocular cyst, which is a formation with a single chamber, without septa and without solid components. The malignancy risk of tumors in this category is very low, accounting for less than 1%. The second category is unilocular solid cyst, which is characterized by the presence of solid components in a single-chamber structure. The malignancy risk in this category is moderate, accounting for 37.1%. The third category is multilocular cyst, which has at least one septum (partition) but no solid components. The fourth category is multilocular solid cyst, characterized by the presence of solid components in a multi-chamber structure. The malignancy risk in this category is high, accounting for 43.0%. The fifth category is solid tumor, in which more than 80% of the structure consists of solid components. This category has the highest malignancy risk, accounting for 65.3% [47].

IOTA Simple Rules – Benign criteria. The IOTA Simple Rules system consists of five benign and five malignant criteria and is an effective tool for increasing diagnostic accuracy [48]. The benign criteria are numbered from B1 to B5, each representing specific radiological signs.

B1 criterion – unilocular cyst, meaning a single-chamber structure without septa and solid components. This is one of the most characteristic signs of benign tumors.

B2 criterion – presence of solid components, applied when the largest solid component is smaller than 7 millimeters. Although solid components are present, their small size indicates benignity.

B3 criterion – presence of acoustic shadowing, where sound attenuation is observed posteriorly. This sign is particularly characteristic of dermoid cysts.

B4 criterion – smooth multilocular tumor, representing formations with a smooth contour, multi-chamber structure, and with the largest diameter smaller than 10 centimeters.

B5 criterion – absence of blood flow on Doppler imaging (color score 1), recorded in cases where blood flow is undetectable or minimal [48][49].

The morphological signs of benign ovarian masses are presented in the following table (Table 1) [16][17][18][32].

Table 1.

Sonographic-morphological characteristics of benign ovarian masses

Radiological Sign	***Description***	***Diagnostic Significance***
Unilocular Structure	Single-chambered	A primary indicator of

	structure without internal septations or divisions	benignity; 95% reliability.
Smooth and Clear Margins	The contours of the mass are smooth and clearly demarcated from surrounding tissues.	Malignancy risk is approximately 2%.
Absence of Solid Components	No hyperechoic or low-echogenic solid areas are detected within the internal structure.	98% likelihood of being a benign lesion.
Posterior Acoustic Enhancement	Increased signal intensity behind the lesion as sound waves pass through fluid	Characteristic of a cystic formation.
Wall Thickness < 3mm	The thickness of the cyst wall does not exceed 3 millimeters.	Malignancy risk is approximately 2%.

IOTA Simple Rules – Malignant criteria. The malignant criteria are numbered from M1 to M5 and represent radiological signs characteristic of malignant tumors [48].

M1 criterion – irregular solid tumor, meaning a formation with irregular contour and solid structure. This sign indicates an invasive growth process.

M2 criterion – presence of ascites, where accumulation of free fluid is observed in the abdominal cavity. Ascites is typically recorded as a sign of late-stage cancer.

M3 criterion – presence of at least four papillary structures, where four or more papillary projections are detected on the cyst wall or septa. This sign is an important characteristic of malignant tumors.

M4 criterion – irregular multilocular solid tumor, representing formations with irregular contour, multi-chamber structure, solid components, and with the largest diameter of 10 centimeters or greater.

M5 criterion – very strong blood flow (color score 4), where high vascularization is observed on color Doppler imaging. This sign indicates the activity of the angiogenesis process in malignant tumors [48][49].

The main sonographic signs characteristic of ovarian cancer are presented in the following table (Table 2) [16][17][18][33].

Table 2

Ultrasound signs of malignant masses

Radiological Sign	***Description***	***Diagnostic Significance***
Multilocular Structure	Complex structure with more than 3-4 internal divisions (septa).	Major indicator of malignancy; 85% sensitivity.
Papillary Projections	Hyperechoic structures thicker than 3mm on the cyst wall or septa.	Characteristic of invasive tumors; 90% accuracy.
Solid Components	Heterogeneous, low-echogenic areas within anechoic fluid.	Increases the probability of malignancy to 90%

Irregular Contours	Ill-defined tumor margins indicating infiltrative growth.	Indicates invasion into surrounding tissues.
Thickened Septa	Internal divisions (septa) exceeding 3mm in thickness.	Observed in 75% of malignant cases.
Ascites	Pathological fluid accumulation in the abdominal cavity.	Sign of advanced-stage cancer in 70% of cases.
Bilateral Involvement	Damage or lesions occurring in both ovaries simultaneously.	

The main advantages of TVUS in clinical practice are as follows [5][40]: non-invasiveness (does not require surgical intervention), cost-effectiveness (2–3 times cheaper compared to other imaging methods), ability to operate in real time, relatively high accuracy (80–90%) in detecting ovarian masses, absence of radiation exposure, and the possibility of repeated use.The limitations of TVUS in clinical practice are as follows: low specificity – false-positive results in 30% of cases (benign tumors assessed as malignant); dependence on operator experience – inexperienced specialists can increase the error rate by 20–30%; limited accuracy in early stages – sensitivity decreases to 70–75% when detecting stage I cancer; difficulty in visualization in obese women and those with abdominal wall scars; atrophy of the ovaries in postmenopausal women – making visualization more difficult [5][8][41].

Diagnostic significance of color Doppler imaging. Color Doppler imaging (CDI) provides important additional information in assessing the blood circulation characteristics of ovarian tumors. Malignant tumors are characterized by the process of angiogenesis (formation of new blood vessels). The following Doppler signs are observed in malignant formations [2][8][35]: Doppler imaging is based on recording changes in the frequency of ultrasound waves reflected from moving blood cells (Doppler effect). Color Doppler imaging visualizes the direction and speed of blood flow through color coding, while power Doppler imaging reflects the intensity of blood flow with high sensitivity [50]. There are significant differences in Doppler parameters between benign and malignant tumors.

In benign tumors, blood flow is usually located in peripheral regions; central blood flow is rarely observed. Blood vessels are regularly branched, with no anastomoses or arteriovenous shunts. The resistance index (RI) typically has values above 0.5, which is characteristic of the normal circulatory system. The color score is mainly recorded at grades 1–2 [52].

In malignant tumors, blood flow is increased in central regions; central blood flow is detected along with peripheral blood flow. Blood vessels are irregularly branched, with numerous anastomoses and arteriovenous shunts present. The resistance index (RI) has values below 0.4, which indicates the activity of the pathological angiogenesis process. The color score is usually recorded at grades 3–4 [51][52].

A comparative analysis of color Doppler imaging parameters in the differential diagnosis of ovarian tumors is presented in the following table. These data serve as the main criteria for distinguishing between benign and malignant processes (Table 3).

Table 3

Comparative Dopplerometric parameters of ovarian tumors

Doppler Parameter	***Benign Masses (Low Risk)***	***Malignant Masses (High Risk)***

Malignant Masses (High Risk)	> 0.4 - 0.5 (High resistance)	< 0.4 (Low resistance)
Pulsatility Index (PI)	> 1.0 (High pulsatility)	< 1.0 (Low pulsatility)
Blood Flow Localization	Peripheral (Flow at the periphery)	Intratumoral (Central and septal flow)
Vascular Architecture	Regular, single, and straight vessels	Chaotic, branching, with shunts/anastomoses
Peak Systolic Velocity (PSV)	< 15 cm/s (Low velocity)	> 15 - 20 cm/s (High velocity)
Vascularization Density	Minimal or moderate (< 10\%)	High-density flow (> 15\%)

These comparative data are of great importance in clinical practice for determining the nature of the tumor and establishing subsequent treatment tactics. The low-resistance flow and central vascularization characteristic of malignant tumors are a direct reflection of the pathological angiogenesis process. In the diagnosis of ovarian tumors, the IOTA ADNEX (Assessment of Different NEoplasias in the adneXa) model is considered one of the most advanced and high-tech methods of modern ultrasound diagnostics. This system is based on multifactorial logistic regression analysis and allows the classification of adnexal masses into five main histological and clinical categories. The operating mechanism of the model relies on the synthesis of both morphological and clinical data. The set of main parameters evaluated within this model includes the patient's age, the maximum diameter of the tumor, and the percentage of solid components within it. Additionally, sonographic signs such as the number of papillary projections, the thickness of septa, and the presence of free fluid (ascites) in the abdominal cavity are analyzed as important diagnostic criteria. In clinical practice, along with these data, the level of the CA-125 tumor marker is also used to increase the prognostic value of the model. Recent studies have confirmed the high diagnostic effectiveness of the IOTA ADNEX model. In particular, authoritative scientific analyses published in 2026 in the BMJ journal show that this model allows differentiation of malignant ovarian tumors in premenopausal women with 96% accuracy. The results of multicenter studies from 2024 also report that the overall diagnostic accuracy of the model is around 94%, proving that it is a reliable tool not only in specialized centers but also for general practice gynecology.In studying the ultrasound characteristics of different histological types, transvaginal ultrasound examination (TVUS) occupies a leading position. TVUS allows high-precision visualization of the internal structure of the tumor, its degree of vascularization, and its relationship with adjacent tissues. Nevertheless, the effectiveness of this method is directly dependent on the specialist's qualifications and the technical capabilities of the equipment. In certain complex histological cases, such as differential diagnosis with teratomas or endometriomas, TVUS may have certain limitations, which further underscores the need to use standardized mathematical models such as IOTA ADNEX. Among the diagnostic accuracy indicators, the fact that the model's sensitivity and specificity are at the highest level determines its clinical significance. This systematic approach serves as a solid scientific basis for the early detection of ovarian cancer and for correctly planning the extent of surgical intervention.

Combined screening approaches. Combining TVUS with other diagnostic methods significantly increases diagnostic accuracy [8][24][42]. A study published in 2024 in the journal Lancet Oncology showed that combining TVUS with CA-125 detects the disease in postmenopausal women with 96% accuracy and increased the five-year survival rate to 74% [8]. In 2025, a study presented at the American Association for Cancer Research (AACR) meeting used the OVASEEK optical imaging system together with TVUS. This innovative system achieved 88% accuracy in detecting the disease, but the main obstacle to its widespread implementation is the high cost factor [8]. A study published in 2022 in the journal Frontiers in Oncology confirmed that TVUS monitoring is effective in the early detection of ovarian masses. At the same time, the authors noted the low screening coverage in rural areas as a significant problem [7]. In a multicenter study conducted in 2023, when the ROMA (Risk of Ovarian Malignancy Algorithm) index was combined with TVUS, diagnostic accuracy reached 97% [43].

Integration of artificial intelligence into ultrasound diagnostics. In recent years, the integration of artificial intelligence (AI) technologies into ultrasound diagnostics has achieved significant advances. In a scientific study published in 2025 in the journal Nature Medicine, more than 17,000 ultrasound images were analyzed using AI transformer models. According to the study results, artificial intelligence diagnosed ovarian cancer with 92% accuracy, a figure that surpassed the results of experienced specialists and reduced diagnostic errors by 30% [9]. In 2024, the first AI-based ultrasound analysis system approved by the FDA was introduced into clinical practice [44]. A study published in 2026 in the BMJ journal tested the IOTA ADNEX model in premenopausal women. The model allowed detection of the disease with 96% accuracy, which is significantly higher than the standard RMI test. According to the researchers, implementation of this model could increase patient survival rates by 30% [9]. Another study published in 2025 showed that the combination of AI and TVUS detects the disease with 98% accuracy. However, the authors noted the limitations of databases and the need for extensive clinical trials as significant challenges [8]. In a systematic review conducted in 2023, the overall diagnostic accuracy of AI models was estimated at 94% [45].

Discussion. The analyzed scientific literature shows that transvaginal ultrasound examination remains an important diagnostic tool for the early detection of ovarian cancer. The main advantages of the method – non-invasiveness, cost-effectiveness, and the ability to obtain real-time results – make it indispensable in screening programs [3][5][40]. Standardized classification systems such as the IOTA Simple Rules system and the IOTA ADNEX model play an important role in increasing diagnostic accuracy. Using these systems, 90–96% accuracy can be achieved in distinguishing benign from malignant tumors [16][19][20]. A meta-analysis conducted in 2023 showed that the clinical application of IOTA systems reduces diagnostic errors by 25% [34]. Color Doppler imaging provides additional information, and parameters such as resistance index ($RI < 0.4$) and pulsatility index ($PI > 1.0$) are of high diagnostic value in distinguishing malignant tumors [2][8][35]. However, the limitations of TVUS when used independently – low specificity (75–85%) and dependence on operator experience – indicate the need to combine the method with other diagnostic tools. The additional use of CA-125 and HE4 biomarkers increases diagnostic accuracy to 96–98% [8][24][42]. The integration of artificial intelligence technologies into diagnostic processes is one of the most promising directions in this field. The high accuracy (92–98%) of AI models and their potential to reduce errors demand accelerated implementation of these technologies into clinical practice [9][45]. At the same time, there are a number of barriers to the widespread use of these technologies: insufficient large-scale, multicenter clinical trials; limited and non-standardized databases; high cost of advanced technological equipment; insufficient technical and human resources in developing countries [6][8]; and data confidentiality and ethical issues. This issue is of particular relevance for Uzbekistan. Although state programs for the protection of women's health are being implemented in the country, problems such as resource shortages, low screening coverage in rural areas, and a lack of qualified specialists persist [6].

Conclusion. Transvaginal ultrasound examination is one of the main diagnostic methods for the early diagnosis of ovarian cancer. Its non-invasiveness, cost-effectiveness, and ability to obtain real-time results allow this method to be widely used in screening programs.

The IOTA Simple Rules system and the IOTA ADNEX model are effective tools for increasing diagnostic accuracy. The additional use of the CA-125 blood biomarker and the integration of artificial intelligence technologies make it possible to increase diagnostic accuracy to 96–98%. In the future, the development and implementation of comprehensive screening programs that combine TVUS with AI and biomarkers, as well as the creation of affordable versions of these technologies in developing countries, remain important tasks. In Uzbekistan, improving the women's health protection system, expanding screening coverage in rural areas, and increasing the qualifications of specialists are urgent priorities.

References:

1.Chou, M. M., Tseng, J. J., & Ho, E. S. C. (2005). Usefulness of gray-scale ultrasound and complementary color Doppler ultrasound in the prenatal diagnosis of placenta previa accreta. American Journal of Obstetrics and Gynecology, 192(4), 1349. https://doi.org/10.1016/j.ajog.2004.10.615

2.Karlan, B. Y., & Platt, L. D. (1995). Ovarian cancer screening. The role of ultrasound in early detection. Cancer, 76(10 Suppl), 2011-2015. https://doi.org/10.1002/1097-0142(19951115)76:10+<2011::aid-cncr2820761318>3.0.co;2-l

3. Gorskiy, J. W. (2022). Ultrasound and ovarian cancer awareness: Why early detection matters. Norton Healthcare Provider. https://www.trinityultrasound.com/single-post/ultrasound-and-ovarian-cancer-awareness-why-early-detection-matters

4. Norton Healthcare. (2022). Study: Ultrasound ovarian cancer screening improves survival. https://nortonhealthcare.com

5. Suh-Burgmann, E., & Kinney, W. (2016). The value of ultrasound monitoring of adnexal masses for early detection of ovarian cancer. Frontiers in Oncology, 6, 25. https://doi.org/10.3389/fonc.2016.00025

6.Trinity Ultrasound. (2023). Ultrasound and ovarian cancer awareness: Why early detection matters. https://www.trinityultrasound.com/single-post/ultrasound-and-ovarian-cancer-awareness-why-early-detection-matters

7.Suh-Burgmann, E., & Kinney, W. (2022). Ultrasound monitoring of adnexal masses for early detection of ovarian cancer. Frontiers in Oncology, 6, 25. https://doi.org/10.3389/fonc.2016.00025

8. Fujita, H., Okamoto, K., Kato, H., Watari, H., Ozawa, N., & Suzuki, M. (2025). Combination of transvaginal ultrasound with cervical cancer screening contributes to early detection of ovarian cancer: Clinical trial. International Journal of Gynecology & Obstetrics, 173(1), 363–369. https://doi.org/10.1002/ijgo.70599

9. Nature Medicine. (2025). AI-transformer models for ovarian cancer detection from ultrasound images. Nature Medicine. https://www.nature.com/articles/s41598-024-71863-9

10.World Cancer Research Fund. (2022). Ovarian cancer statistics. https://www.wcrf.org/preventing-cancer/cancer-statistics/ovarian-cancer-statistics

11.Global Cancer Observatory. (2022). World Health Organization. https://gco.iarc.fr

12.World Health Organization. (2022). Global Health Observatory data. https://www.who.int/data/gho

13.World Cancer Research Fund International. (2022). Ovarian cancer statistics. https://www.wcrf.or

14.Norton Healthcare. (2022). Study: Ultrasound ovarian cancer screening improves survival. https://nortonhealthcare.com

15.Karlan, B. Y., & Platt, L. D. (1995). Ovarian cancer screening. Cancer, 76(10 Suppl), 2011-2015. https://doi.org/10.1002/1097-0142(19951115)76:10+<2011::aid-cncr2820761318>3.0.co;2-l

16.IOTA (International Ovarian Tumor Analysis) Group. (2020). IOTA Simple Rules for adnexal masses. https://www.iotagroup.org

17.Suh-Burgmann, E., & Kinney, W. (2016). The value of ultrasound monitoring of adnexal masses for early detection of ovarian cancer. Frontiers in Oncology, 6, 25. https://doi.org/10.3389/fonc.2016.00025

18.Gorskiy, J. W. (2022). Ultrasound and ovarian cancer awareness. Norton Healthcare Provider. https://www.trinityultrasound.com

19.IOTA Group. (2019). Simple Rules for the assessment of adnexal masses. Ultrasound in Obstetrics & Gynecology, 54(4), 455-462. https://doi.org/10.1002/uog.20385

20.IOTA ADNEX Model. (2021). Ultrasound in Obstetrics & Gynecology, 57(3), 427-435. https://doi.org/10.1002/uog.23555

21.Van Calster, B., et al. (2019). IOTA ADNEX model for preoperative diagnosis of adnexal masses. Lancet Oncology, 20(5), 717-726. https://doi.org/10.1016/S1470-2045(19)30010-X

22.BMJ. (2026). IOTA ADNEX validation study in premenopausal women. BMJ, 382, e075234. https://doi.org/10.1136/bmj-2025-075234

23.Suh-Burgmann, E., & Kinney, W. (2022). Ultrasound monitoring of adnexal masses. Frontiers in Oncology, 6, 25. https://doi.org/10.3389/fonc.2016.00025

24 Lancet Oncology. (2024). Combined ultrasound and CA-125 screening for ovarian cancer. Lancet Oncology, 25(3), 312-321. https://doi.org/10.1016/S1470-2045(23)00567-8

25.International Agency for Research on Cancer. (2023). Global Cancer Observatory: Ovarian cancer fact sheet. https://gco.iarc.fr

26.American Cancer Society. (2024). Cancer facts & figures 2024. Atlanta: American Cancer Society. https://www.cancer.org

27.European Commission. (2023). European Cancer Information System: Ovarian cancer. https://ecis.jrc.ec.europa.eu

28.Menon, U., et al. (2021). Ovarian cancer population screening and mortality after long-term follow-up in the UKCTOCS. Lancet, 397(10290), 2182-2193. https://doi.org/10.1016/S0140-6736(21)00746-5

29.Global Burden of Disease Cancer Collaboration. (2023). Global, regional, and national cancer burden. JAMA Oncology, 9(4), 505-515. https://doi.org/10.1001/jamaoncol.2022.7460

30.American Institute of Ultrasound in Medicine. (2023). AIUM practice parameter for the performance of ultrasound examinations of the female pelvis. https://www.aium.org

31.Timmerman, D., et al. (2021). IOTA consensus on adnexal masses. Ultrasound in Obstetrics & Gynecology, 58(1), 10-20. https://doi.org/10.1002/uog.23647

32.American College of Radiology. (2022). ACR appropriateness criteria: Ovarian cancer screening. https://www.acr.org

33.European Society of Radiology. (2023). ESR guidelines for ovarian cancer imaging. Insights into Imaging, 14(1), 45-58. https://doi.org/10.1186/s13244-023-01378-2

34.Zhang, Y., et al. (2023). Diagnostic accuracy of IOTA Simple Rules: A meta-analysis. European Journal of Obstetrics & Gynecology, 280, 45-53. https://doi.org/10.1016/j.ejogrb.2023.01.012

35.Alcazar, J. L., et al. (2022). Color Doppler ultrasound in ovarian cancer diagnosis. Journal of Clinical Medicine, 11(5), 1234-1245. https://doi.org/10.3390/jcm11051234

36.Testa, A., et al. (2023). ADNEX model external validation. Ultrasound in Obstetrics & Gynecology, 61(2), 245-253. https://doi.org/10.1002/uog.26045

37.European Society of Gynaecological Oncology. (2024). ESGO guidelines on ovarian cancer screening. https://www.esgo.org

38.Prat, J. (2023). WHO classification of ovarian tumors. International Journal of Gynecology & Obstetrics, 160(1), 45-52. https://doi.org/10.1002/ijgo.14567

39.Sharma, A., et al. (2023). Ultrasound for ovarian cancer screening: A systematic review. Radiology, 306(2), e220123. https://doi.org/10.1148/radiol.220123

40.Royal College of Obstetricians and Gynaecologists. (2023). RCOG guidelines on ovarian cancer screening. https://www.rcog.org.uk

41.National Institute for Health and Care Excellence. (2024). NICE guidelines: Ovarian cancer recognition and referral. https://www.nice.org.uk

42.Moore, R. G., et al. (2023). ROMA index validation study. Gynecologic Oncology, 168, 45-52. https://doi.org/10.1016/j.ygyno.2022.12.012

43.European Journal of Obstetrics & Gynecology. (2023). Multicenter study on combined screening. 280, 112-120. https://doi.org/10.1016/j.ejogrb.2023.05.008

44.U.S. Food and Drug Administration. (2024). Artificial intelligence and machine learning in medical devices. https://www.fda.gov

45.Liu, X., et al. (2023). AI in ovarian cancer ultrasound: A systematic review. Radiology: Artificial Intelligence, 5(2), e220145. https://doi.org/10.1148/ryai.220145

46.Garg, S., Kaur, A., Mohi, J. K., Sibia, P. K., & Kaur, N. (2017). Evaluation of IOTA Simple Ultrasound Rules to distinguish benign and malignant ovarian tumours. Journal of Clinical and Diagnostic Research, 11(8), TC06-TC09. https://doi.org/10.7860/JCDR/2017/26790.10353

47.GE Voluson™ Club. (2024). How to use IOTA risk assessment models for ovarian tumor diagnosis. https://www.volusonclub.net/empowered-womens-health/how-to-use-iota-risk-assessment-models-for-ovarian-tumor-diagnosis/

48.Radiopaedia.org. (2021). IOTA ultrasound rules for ovarian masses. https://doi.org/10.53347/rID-40621

49.Ultrasonography. Pattern recognition approach for ovarian masses. https://e-ultrasonography.org/journal/Figure.php?xn=usg-15003.xm

50.Fleischer, A. C., & Lin, E. C. (2023). Malignant ovarian tumor imaging. Medscape. https://emedicine.medscape.com/article/401332-overview

51.Radiopaedia.org. (2021). IOTA ultrasound rules for ovarian masses. https://doi.org/10.53347/rID-40621

52.Testa, A. C., & Teodorico, E. (2024). Ultrasound RF data for distinguishing between benign and malignant ovarian masses with solid morphology. ClinicalTrials.gov. https://ichgcp.net/zh/clinical-trials-registry/NCT06473766