MODERN ULTRASOUND CAPABILITIES IN THE DIAGNOSIS OF UTERINE FIBROIDS: 2D, 3D AND DOPPLER ULTRASOUND

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Abstract

Uterine fibroids are one of the most common benign tumors of the female reproductive system, occurring, according to various authors, in 20–40% of women of reproductive age (Stewart E.A., 2020). Fibroids occupy a leading position in the structure of gynecological morbidity and remain the main cause of surgical interventions in women over 35 years of age. Modern diagnostics of uterine fibroids is unthinkable without the use of ultrasound methods. Ultrasound is the "gold standard" for the primary detection of fibroid nodes, allowing one to determine their location, size, number, blood supply, and assess growth dynamics. According to a study by Salim R. et al. (2018), the diagnostic accuracy of 3D ultrasound in assessing submucosal fibroids is 94–96%, which is significantly higher compared to the 2D method (approximately 80%). Thus, the relevance of this topic is determined by the need for a comprehensive approach to ultrasound diagnostics of uterine fibroids using both 2D and 3D modes, as well as Doppler technologies.

Keywords: Uterine fibroids; ultrasound diagnostics; 2D echography; 3D echography; Doppler sonography; vascular imaging.

Study objective: To comprehensively assess the informativeness and diagnostic value of 2D and 3D echography and Doppler sonography.

Study materials and methods: The study included 60 patients of reproductive age (25 to 45 years old) undergoing observation in the obstetrics and gynecology department. All women presented with complaints of menstrual irregularities (heavy or prolonged periods, intermenstrual bleeding), lower abdominal pain, and symptoms associated with an enlarged uterus (pressure on the bladder and intestines). The ultrasound examination was performed on expert-class equipment using transabdominal and transvaginal transducers with a frequency of 3.5–7.5 MHz. Each patient underwent a comprehensive examination, including:
1. 2D ultrasound – to assess the location, number, and size of myomatous nodes, their impact on the uterine cavity, and the condition of the endometrium and ovaries.
2. 3D ultrasound – to clarify the spatial characteristics of the nodes, their relationship with surrounding structures, and to determine uterine cavity deformation.

3. Color and power Doppler mapping – to assess the degree of vascularization of the myomatous nodes, the nature of blood flow (peripheral or central), and to differentiate myomas from other uterine masses.

Patients were divided into three groups:

Group 1 (n = 20) – examined primarily using standard 2D ultrasound.

Group 2 (n = 20) – additional 3D scanning was performed.

Group 3 (n = 20) – the full suite of 2D, 3D, and Doppler imaging was used.

Study Results. The average age was 36.4 ± 4.8 years. In 38 women (63.3%), uterine fibroids were diagnosed for the first time, in 22 (36.7%) there were previously reported data on nodular formations. The main complaints were: menstrual cycle disorders (heavy or prolonged menstruation) - 41 patients (68.3%); pain in the lower abdomen and lower back - 27 (45.0%); a feeling of pressure on the bladder or intestines - 14 (23.3%); reproductive problems (infertility, habitual miscarriage) - 11 (18.3%). According to the localization, myomatous nodes were distributed as follows: subserous - 15 (25.0%); intramural - 28 (46.7%); submucosal - 12 (20.0%); mixed forms - 5 (8.3%). All women underwent standard transabdominal and transvaginal 2D ultrasound. Myomatous nodes were clearly visualized in 92% of cases. 3D ultrasound was used in 40 patients (Groups 2 and 3). It allowed for a more accurate determination of the location and size of nodes in 95% of cases. In all women with submucosal myoma (n=12), 3D ultrasound enabled a reliable assessment of the degree of uterine cavity deformation and the node-to-endometrium relationship. This method identified additional small nodes (5–10 mm), not visualized with standard 2D scanning, in 6 patients (15%).

In three cases, the type of nodule growth (submucosal component of an intramural mass) was determined. Thus, 3D ultrasound significantly expands diagnostic capabilities, especially in cases of submucosal localization and multiple nodules. Doppler mapping was performed in 20 women (Group 3). In 90% of cases, peripheral blood flow, typical of myomatous nodules, was detected. Central vascularization was detected in four patients, which may indicate pronounced proliferative activity of the nodule. Doppler ultrasound enabled differential diagnosis with adenomyosis and malignant tumors. Three patients showed signs of impaired intranodal blood flow (decreased resistance index, localized avascular zones), indicating degenerative changes.

Thus, Doppler ultrasound proved highly informative in assessing the functional state of the nodules and their biological activity.

CONCLUSIONS

2D ultrasound remains the standard diagnostic method for uterine fibroids, allowing for the detection of nodes, their number, and size in 92% of cases. However, this method is limited in assessing the topography of submucosal nodes and small lesions. 3D ultrasound offers significant advantages, providing a more accurate determination of the location and spatial characteristics of fibroid nodes, as well as identifying additional small lesions. Its diagnostic value has been particularly high for submucosal fibroids.

Doppler ultrasonography is an indispensable tool for assessing blood flow and proliferative activity of nodes. Peripheral vascularization was observed in the majority of cases (90%), while central vascularization was observed in 10% of patients. This can serve as a marker of aggressive growth and predictive value for recurrence. The most informative results are achieved with the combined use of all three methods (2D + 3D + Doppler ultrasonography), which allows for a more precise determination of the morphological and functional characteristics of the fibroid, increased accuracy of differential diagnosis, and the selection of optimal treatment strategies.

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