

## MODERN POSSIBILITIES OF ULTRASOUND DIAGNOSTICS OF UTERINE FIBROIDS AND ASSESSMENT OF THEIR IMPACT ON REPRODUCTIVE FUNCTION

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### ABSTRACT

Uterine fibroids are one of the most common benign tumors in women of reproductive age and are a leading cause of menstrual irregularities, infertility, and miscarriage. Modern ultrasound diagnostic techniques, including the use of a transvaginal transducer, color Doppler mapping (CDM), 3D reconstruction, and elastography, allow not only to identify fibroid nodules but also to assess their structure, vascularization, and impact on the functional state of the endometrium. The aim of this study was to comprehensively evaluate the ultrasound characteristics of uterine fibroids and their clinical significance for women's reproductive health.

**Keywords:** Uterine fibroids, ultrasound, reproductive function, echostructure, blood flow, diagnostics.

### STUDY OBJECTIVE

To determine the diagnostic capabilities of ultrasound (including CDM and 3D imaging) in assessing the structural features of uterine fibroids and their impact on women's reproductive function. Study Materials and Methods

The study included 72 women aged 25 to 45 years who presented to the gynecology department with complaints of menstrual irregularities, infertility, or pain. The patients were divided into three groups based on their reproductive status: Group 1 (n=24) included patients with uterine fibroids but no reproductive dysfunction; Group 2 (n=26) included patients with fibroids and infertility; Group 3 (n=22) included patients with fibroids and a history of miscarriage. All women underwent transvaginal ultrasound using expert-class equipment. Uterine size, location and number of fibroid nodes, their echogenicity, structure, signs of degeneration, endometrial condition, and blood flow parameters using color Doppler imaging were assessed. Some patients also underwent 3D ultrasound and elastography to clarify tissue density characteristics. Study Results

The study included 72 women of reproductive age with various forms of uterine fibroids. The average age of the patients was  $35.6 \pm 4.8$  years. Based on ultrasound data and clinical characteristics, three groups were identified: Group 1 (n=24) included patients with uterine fibroids and no reproductive dysfunction; Group 2 (n=26) included patients with fibroids and infertility; Group 3 (n=22) included patients with fibroids and miscarriage.

Morphological features of the nodules: 49 patients (68%) had intramural fibroids, 16 (22%) had subserosal fibroids, and 7 (10%) had submucosal fibroids. The number of nodules ranged from 1 to 5, and their sizes ranged from 1.2 to 6.8 cm. Multiple intramural-subserosal nodules were observed in 62% of cases. The fibroid contours were predominantly clear, with a hypoechoic or

moderately heterogeneous echotexture. Degenerative changes, including areas of cystic remodeling and calcifications, were observed in 19%.

Endometrial status: in groups 2 and 3, uterine cavity deformation due to nodes proximal to the endometrium was observed in 73% and 68% of cases, respectively. Endometrial thickness was reduced in 31% of patients with submucous fibroids. In group 1, endometrial deformation was observed in only 8%

Color Doppler mapping revealed increased vascularity along the periphery of the nodes and the presence of central vessels with a low resistance index ( $IR = 0.42-0.48$ ) in groups 2 and 3. The higher the degree of node vascularization, the more pronounced the clinical manifestations, including pain, hypermenorrhea, and anemia. 3D ultrasound allowed visualization of the degree of uterine cavity deformation. In the infertility group (2nd), 61% of patients had abnormal cavity contours, and 45% had endometrial line displacement. Elastography revealed an average nodal stiffness index of  $2.8 \pm 0.5$  kPa compared to  $1.9 \pm 0.4$  kPa in the intact myometrium, reflecting the fibrotic nature of the myomatous tissue. Reproductive outcomes: Patients with submucosal and intramural nodes larger than 3 cm were more likely to suffer infertility and miscarriage. In Group 2, anovulation was observed in 27% of patients, and endometrial thinning was observed in 35%. In Group 3, chronic endometritis was diagnosed in 41% of patients, likely due to cavity deformation and impaired microcirculation.

Thus, a relationship was identified between the location, structure, and blood flow of myomatous nodes and reproductive dysfunction. Modern ultrasound techniques make it possible to predict the impact of myoma on conception and pregnancy.

## CONCLUSIONS

1. Ultrasound examination using color Doppler and 3D technologies provides high information content in the diagnosis and characterization of uterine myoma.
2. Intramural and submucous fibroids have the greatest impact on reproductive function, causing deformation of the uterine cavity and implantation failure.
3. A comprehensive ultrasound assessment of the structure and blood flow of fibroid nodes is essential when planning pregnancy and choosing a treatment method.
4. The use of modern ultrasound technologies allows for individualized patient care and increases the effectiveness of reproductive care.