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CLINICAL AND DIAGNOSTIC ASPECTS OF UTERINE LEIOMYOMA

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Abstract
Uterine leiomyoma is one of the most common benign tumors among women of reproductive age, and its clinical manifestations and diagnostic evaluation remain a relevant issue in modern gynecology. This article analyzes the clinical features of uterine leiomyoma, including abnormal uterine bleeding, dysfunction of the pelvic organs, and anemia. Additionally, the role of hormonal, morphological, and immunological factors in the development of leiomyoma is highlighted.
The article evaluates modern diagnostic methods used in the detection of uterine leiomyoma, such as transvaginal ultrasonography, Doppler imaging, hydrosonography, magnetic resonance imaging, hysteroscopy, and angiography, emphasizing their informativeness and clinical significance. The importance of imaging methods in determining the localization of myomatous nodules and assessing their proliferative activity is also discussed.
The findings indicate the necessity of early diagnosis of uterine leiomyoma, individualized treatment planning, and the improvement of clinical and diagnostic approaches to prevent possible complications.
Keywords: uterine leiomyoma, myomatous nodules, abnormal uterine bleeding, diagnostics, ultrasonography, hysteroscopy

КЛИНИЧЕСКИЕ И ДИАГНОСТИЧЕСКИЕ АСПЕКТЫ ЛЕЙОМИОМЫ МАТКИ

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Аннотация
Лейомиома матки является одной из наиболее распространенных доброкачественных опухолей у женщин репродуктивного возраста, и её клинические проявления и методы диагностики остаются актуальной проблемой современной гинекологии. В данной статье проанализированы клинические особенности лейомиомы матки, включая аномальные маточные кровотечения, нарушение функции органов малого таза и анемию. Кроме

того, подчеркнута роль гормональных, морфологических и иммунологических факторов в развитии лейомиомы.
В статье рассматриваются современные диагностические методы выявления лейомиомы матки, такие как трансвагинальное ультразвуковое исследование, допплерография, гидросонография, магнитно-резонансная томография, гистероскопия и ангиография, с акцентом на их информативность и клиническую значимость. Также обсуждается важность визуализирующих методов для определения локализации миоматозных узлов и оценки их пролиферативной активности.
Результаты исследования подчеркивают необходимость ранней диагностики лейомиомы матки, индивидуального планирования лечения и совершенствования клинических и диагностических подходов для предотвращения возможных осложнений.
Ключевые слова: лейомиома матки, миоматозные узлы, аномальные маточные кровотечения, диагностика, ультразвуковое исследование, гистероскопия

Introduction.

Uterine fibroids (UF) are benign, monoclonal, and hormonally sensitive tumors that develop as a result of the proliferation of phenotypically altered smooth muscle cells of the myometrium. Myomatous nodules are usually round in shape, and their size may vary from a few millimeters to large masses reaching several tens of centimeters. Uterine leiomyoma is very rare in girls of pubertal age; however, after the age of 30, its prevalence reaches 30–40%. During menopause, due to a decrease in the secretion of sex steroid hormones, the development and growth of uterine leiomyomas in most cases slow down or cease. This fact confirms the decisive role of ovarian hormones in the pathogenesis of uterine fibroids [5].

In the development of leiomyoma, smooth muscle layer cells undergo excessive proliferation beyond normal regulatory mechanisms. The formation of leiomyoma usually proceeds slowly: initially, a single smooth muscle cell begins uncontrolled division, and as the number of cells gradually increases, myomatous nodules develop within the uterine wall [12].

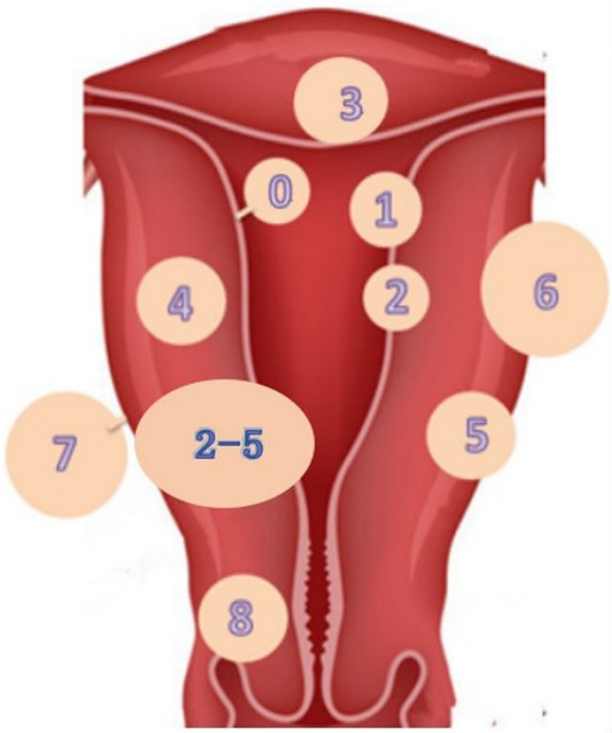
Uterine fibroids demonstrate varying prevalence among different racial groups, with the highest rates observed in Black women and the lowest in women of Asian descent. Epidemiological data on racial groups other than Caucasian and African American women remain limited. Studies conducted by Laughlin and co-authors showed that the prevalence of fibroids was 18% among Black women, 8% among White women, 10% among Hispanic women, and 13% in the “other” group, which consisted predominantly of women of Asian origin [15].

Uterine leiomyoma is a benign uterine tumor originating from the myometrium, the development of which is based on the active proliferation of smooth muscle cells and connective tissue elements. Comparative ultrastructural analysis of collagen fibrils in leiomyoma tissue versus normal myometrium has revealed atypical features in their structure and arrangement. These morphological changes indicate the significant role of matrix metalloproteinases—particularly collagenases and gelatinases—in the pathogenesis of leiomyoma. Such alterations in the connective tissue component may be associated with hormonal imbalance observed in women [6].

Based on the results of numerous clinico-morphological studies, the common (simple) form of uterine fibroid is considered a benign tumor with low biological activity and slow growth. In this form, the tumor structure is predominantly composed of connective tissue, accompanied by phenotypic changes in myocytes, as well as reduced blood supply in both the myometrium and myomatous nodules.

In contrast, proliferative uterine fibroids are characterized as benign tumors with clinically active behavior, multiple nodules, and rapid growth. These fibroids possess high proliferative potential and are often associated with proliferative changes in the endometrium, tumor-like formations, and benign or malignant ovarian neoplasms. According to some authors, proliferative fibroids are diagnosed in approximately every fourth patient. Histologically, although myogenic components in these fibroids do not exhibit cellular atypia, their quantity is significantly greater compared to fibroids without signs of proliferation. While mitotic activity is almost absent in simple fibroids, an increased number of mitoses is observed in proliferative fibroids. Experts emphasize that classification of uterine fibroids based on histogenetic characteristics is of great importance in clinical practice, particularly in determining individualized treatment strategies [9].

Uterine bleeding is one of the major problems of emergency gynecology and accounts for 18–23% of causes of female mortality. Bleeding is considered one of the most reliable clinical signs of leiomyoma. Uterine leiomyoma is among the most common benign tumors of the female pelvic organs and is diagnosed in approximately 20% of women over 35 years of age and in up to 40% of women older than 50 years. As the size of myomatous nodules increases, dysfunction of adjacent organs may occur, including constipation and dysuric disorders. Conservative methods aimed at controlling bleeding, hormonal therapy, as well as minimally invasive procedures such as hysteroscopic endometrial curettage, do not always provide the expected therapeutic effect. Moreover, these surgical interventions are closely associated with the risk of postoperative complications, which may subsequently lead to scar formation and adhesions in the pelvic cavity [1].



0	Pedunculated submucous fibroid
1	submucous fibroid, ＜ 50% intramural
2	submucous fibroid, ≥50% intramural
3	completely intramural fibroid but abutting the endometrium
4	completely intramural without Contact with endometrium or serosa
5	Subserous fibroid, ≥50% intramural
6	Subserous fibroid, ＜50% intramural
7	Pedunculated Subserous fibroid
8	others (e.g. cervical, parasitic)
2-5	Submucosal and subserosal, eath with less than half the diameter in the endometrial and peritoneal cavities, respectively

FIGO classification of uterine fibroids (leiomyomas)

Diagnosis

The evaluation of uterine fibroids is primarily based on the clinical symptoms observed in patients. These include abnormal uterine bleeding, complaints related to mass effect, pelvic pain, and signs characteristic of anemia. In some cases, myoma nodules may be incidentally detected during routine pelvic examinations or imaging studies in asymptomatic women [10].

Clinically significant subserosal and intramural myoma nodules are often diagnosed based on pelvic examination findings. The main diagnostic signs include an enlarged uterus, irregular shape, firm consistency, and absence of tenderness [18].

Currently, various diagnostic methods are used to identify leiomyoma, assess its localization, and determine tumor characteristics. These include ultrasonography, Doppler studies, three-dimensional ultrasound tomography, magnetic resonance imaging (MRI), hydrosonography, and angiography. In addition, hysteroscopy and laparoscopy remain highly effective diagnostic methods.

Transvaginal ultrasonography (TVUS) is considered the most effective screening diagnostic tool. Determining the location of myoma nodules is particularly important in myomectomy, as it often dictates the choice of surgical approach. With the introduction of hydrosonography (HSG), the diagnostic capabilities of

ultrasound in assessing uterine fibroids have significantly expanded. This method is widely used prior to transcervical resection of myomatous nodules, as it provides valuable diagnostic information and reduces the risk of surgical complications. HSG allows precise identification of the type of submucosal node, its relationship to the internal cervical os and uterine cornua, assessment of myometrial thickness up to the serosal layer, and more accurate visualization of the bed of interstitial-subserosal nodules and their proximity to the uterine cavity. The creation of an acoustic window enhances visualization of intrauterine pathology, increasing the sensitivity of hydrosonography in determining fibroid localization to nearly 100% [3].

Uterine size assessed by bimanual examination shows a high degree of correlation with uterine volume and weight determined by pathological examination, even in women with a body mass index greater than 30. In cases where the clinical diagnosis is sufficiently clear, routine ultrasonography is not required. However, to reliably detect submucosal fibroids, additional diagnostic methods such as saline infusion sonography, hysteroscopy, or MRI are necessary [11].

Imaging diagnostic methods enable non-invasive and repeatable evaluation of tumor formations and play a crucial role in detecting leiomyomas and confirming their precise localization. In clinical practice, ultrasonography is considered the first-line imaging modality for leiomyoma assessment due to its accessibility, speed, and ease of use [17].

Color Doppler mapping (CDM), combined with echographic imaging, allows assessment of qualitative and quantitative parameters of blood supply to the examined structure and helps predict its histological characteristics. In most cases, non-mosaic blood flow is observed at the periphery of the tumor, while in approximately one-third of cases, blood flow is also detected within the tumor tissue. Proliferative myomatous nodules typically demonstrate diffuse or mixed blood flow patterns. In both simple and proliferative fibroids, blood flow velocity (Vmax) is relatively low, ranging from 0.12 to 0.25 cm^3/s, while the resistance index (RI) ranges from 0.58–0.69 and 0.50–0.56, respectively [7].

Another important diagnostic method in uterine fibroid evaluation is angiography. Studies were performed using the PHILIPS INTEGRIS V5000 angiographic system, with selective arterial catheterization and administration of 4–6 ml of Ultravist-370 or Omnipaque-350 contrast agents at a rate of 12–16 ml/s, allowing visualization of blood flow and vascularization of myomatous nodules [8].

Computed tomography (CT) is an important imaging modality for assessing clinically manifest symptoms. In most cases, CT reveals well-defined soft tissue masses with heterogeneous internal structure. However, one of the main limitations of CT is its insufficient ability to visualize fine uterine anatomical structures and

difficulty in determining the exact origin of the lesion, which may lead to misinterpretation of adnexal masses as uterine tumors [17].

Due to its high contrast resolution for tissue differentiation, multiplanar imaging capability, and reproducibility of results, magnetic resonance imaging (MRI) is considered the most reliable imaging method for detecting and evaluating uterine fibroids. However, compared to ultrasonography, MRI is more time-consuming, economically expensive, and is used in practice only when specific indications are present [16].

During hysteroscopic examination, the clinical picture may vary depending on the localization of myoma nodules and the phase of the menstrual cycle. In the first half of the cycle, the endometrium is usually relatively thin and pale pink. Well-defined, round or oval submucosal myoma nodules with smooth or slightly irregular surfaces are visualized within the uterine cavity. Deformation of the endometrium around the nodules and enhanced visualization of blood vessels on the nodule surface may be observed. In some cases, myoma nodules partially or completely occupy the uterine cavity, altering its configuration [4].

According to other authors, performing mini-hysteroscopy on days 6–8 of the menstrual cycle is considered optimal for diagnosing uterine fibroids. This method utilizes a 2.5-mm hysteroscope, allowing examination of the uterine cavity without cervical dilation and without causing endometrial trauma. In cases of suspected submucosal or endometrium-adjacent nodules, hystero-resectoscopy with targeted biopsy from the suspected area may be performed. Hysteroscopy serves not only as a diagnostic tool for detecting fibroids but also provides opportunities for organ-preserving surgical treatment in women of reproductive age [2].

Recent scientific studies have demonstrated that immunological mechanisms play a significant role in the development of uterine leiomyoma and its complications. The use of specific immunological markers reflecting the body’s immune response makes it possible to identify the growth rate of leiomyoma and the risk of complications at an early stage [13].

Determination of cytokine concentrations in various types of myomatous nodules enables deeper understanding of leiomyoma pathogenesis and facilitates the development of pathogenetic preventive and therapeutic strategies [14].

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