



## Ultrasound Diagnosis of the Norm and Diseases of the Cervix

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**Abstract:** The article reflects modern concepts of ultrasound diagnostics of changes in the cervix. Summarized data on dimensions and measurement techniques are given. Topical issues of the most common changes in the cervix are considered.

**Keywords:** ultrasound, endocervix, decidualos, cervical myoma, endometritis, endocervicitis, dysplasia.

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Ultrasound examination is carried out using modern equipment, which allows obtaining high-quality results. Ultrasound is the simplest and most informative method of obtaining the necessary information - it allows you to constantly monitor how the treatment process is going.

Ultrasound of the cervix is performed using energy Doppler mapping, which makes it possible to visualize even the smallest vessels. Thanks to three-dimensional reconstruction, the image is richer, thus, pathologically altered areas are detected quite easily and quickly.

At the present stage of development of medicine, gynecology and ultrasound are inseparable. The following are the most common changes in the cervix in women in gynecology today.

To identify changes in the cervix using ultrasound, it is necessary to perform correctly the entire volume and procedure of the study, to know the normoarchitectonics and topography of the pelvic organs.

The cervix is a hormone-dependent organ and acts as a barrier between the upper genital tract and the external environment. Together with the vagina, it is a single functional system.

3D ultrasound allows you to determine the volume, shape of the cervix, the presence of its deformities, cicatricial changes, various pathological conditions of the endocervix.

Normally, the cervix in women of reproductive age has a cylindrical or conical shape, its length is about 3.2 cm ( $2.9-3.7 \pm 0.6$  cm), its thickness is 2.8 cm ( $2.6-3.0 \pm 0.5$  cm), and the width is 3.5 cm ( $2.9-3.4 \pm 0.5$  cm). The volume of the uterus ranges from 6 to 12 cm<sup>3</sup> ( $5.48 \pm 1.64$  cm<sup>3</sup>). With the operated cervix, its moderate vascularization, uniform symmetric blood flow, rectilinear or weakly curved course of the vessels are observed.

Longitudinal echographic sections allow to obtain an image of the anterior and posterior walls of the cervix, frontal sections - an idea of the right and left lateral walls.

The endocervix has a higher echogenicity than the myometrium, its thickness is about 3-4 mm. The cervical canal is located in the center and has a fusiform shape in frontal sections; its length from the external os to the isthmus is about 4 cm.

Normally, all three zones (muscle tissue of the cervix, endocervix and cervical canal) are clearly traced, have a uniform width, the cervical canal is not deformed. The border between the body and the cervix is in the area of the internal os. In a conventional two-dimensional examination, it is difficult to draw an exact border; 3D ultrasound in frontal sections allows this differentiation to be more clearly realized. In this case, the border is the end zone of the hypoechoic rim of the endometrium.

Due to the scarcity of clinical symptoms in hyperplastic processes of the endocervix, various diagnostic methods are gaining importance. To detect endocervical hyperplasia, cervicoscopy and ultrasound are used, however, accurate diagnosis is possible only with histological examination.

Endocervical hyperplasia with ultrasound is a thickening of the mucous membrane of the cervix, with an increase in its echogenicity and increased vascularization. Due to the overproduction of mucus, the cervical canal is enlarged, which facilitates the visualization of the structure of the endocervix. In the structure of the hyperplastic endocervix, small cysts can be detected against the background of increased echogenicity of the endocervix.

Pathological processes in the endocervix are an indication for diagnostic curettage of the entire mucous membrane of the cervical canal with subsequent histological examination of the material obtained.

Polyps of the mucous membrane of the cervix are found in gynecological patients with a frequency of 1-14% of the entire pathology of the uterus, and more often develop in 40-50 years. Recurrence is observed in 16% of patients. Endocervical polyp is an overgrowth of the mucous membrane of the cervical canal with the involvement of the underlying fibrous tissue in the process.

The endocervical polyp has the form of an oval protrusion of increased echogenicity, and, unlike hyperplasia, has a leg or a wide base. The 3D reconstruction mode assists in accurate topical diagnosis of endocervical polyps, while the superficial reconstruction mode provides cervicoscopic-like images of endocervical polyps. With the help of three-dimensional angiography, visualization of the vascular pedicle of the polyp is possible.

During pregnancy, the decidual tissue grows on the cervix - decidualos, which is due to the corresponding hormonal changes. With 3D ultrasound, the decidual formations are located in the lumen of the cervical canal in the form of polypoid growths with a large number of small anastomosing vessels. Unlike polyps, decidualos does not require treatment and disappears within a few weeks after the end of pregnancy. But, given that 19.3% of pregnant women with decidualos develop dysplasia, and in some cases cervical cancer, the examination of patients should be carried out in accordance with the algorithm itm, adopted for pathology of the cervix. Management of pregnant women with cervical diseases should be carried out under careful dynamic colposcopic and cytological control, with mandatory treatment of urogenital infections and the use of immunocorrective therapy.

Ultrasonic criteria for true polyps of the cervical canal are: the presence of echo-positive formations of medium or low echo density, with a clear vascular pedicle emanating from the middle or lower third of the cervical canal, and with single vascular loci in the internal structure. The resistance index (IR) is 0.66-0.71, the vascularization index (VI) is 0.46-1.24, the blood flow index (FI) is 16.75-28.24.

Ultrasound criteria of decidual pseudopolyps are echo-positive rounded formations of increased echo density without a vascular pedicle, with a large number of vascular loci in the internal structure, with more pronounced hemocirculatory changes. In this case, the following indicators of blood flow are characteristic: IR - 0.50-0.55, VI - 1.33-2.01 and FI - 30.30-44.51, and the number of vascular loci does not depend on the size of the formations.

Uterine myoma of cervical localization quickly leads to deformation of the cervix, compression of surrounding tissues and dysfunction of adjacent organs. The 3D ultrasound mode allows you to more accurately determine the width of the base of the node with its large size. With the onset of menopause, a significant decrease in the size of the cervical fibroid is not observed.

Most often, endometriosis of the cervix occurs after diathermocoagulation (in 0.8-17.8% of cases) and occurs in women aged 35-45 (in 14.9% of cases). Foci (heterotopia) of endometriosis look like bluish cysts, bleeding linear and punctate zones, bright red areas with jagged edges with a brownish tint during cervicocopy.

Sonographically, in patients with endometriosis of the cervix, round formations with echogenic finely dispersed contents are revealed, the structure and size of which vary depending on the menstrual cycle. The 3D reconstruction mode helps to identify changes in these cysts.

In the asymptomatic course of histologically confirmed endometriosis, special treatment is not required; in other cases, lesions are excised, cryosurgery is performed, and hormonal treatment is indicated.

Endocervicitis occurs most often at the age of 18-30 years and can be caused by STIs of bacterial and viral etiology. The disease during the transition to the chronic stage has a long course.

With endocervicitis, there is a thickening of the endocervix, an increase in its echogenicity, the emergence of a rim around the endocervix due to the zone of myometrial edema and expansion of the cervical canal. The contents of the cervical canal can be from anechoic to slightly echoic.

With the long-term existence of the process, the underlying muscle and connective tissue elements of the cervix are involved, and cervicitis occurs. The cervix increases in volume due to the formation of many small and large cysts, which are formed as a result of the healing of ectopia.

Cervical dysplasia is a change in which part of the epithelium is replaced by cells with varying degrees of atypia, loss of complexity and polarity without changing the stroma. During preventive examinations of the cervix, dysplasia is detected in 0.2-2.2% of cases, more often in women aged 30-39 years.

There is no typical ultrasound picture for dysplasias, an echographic picture of cervicitis is observed.

For treatment, laser, cryo, electrosurgical, surgical radical methods of treatment are used.

According to the WHO, more than 500,000 new cases of the disease are diagnosed worldwide every year. In most cases, cervical cancer develops in the transformation zone around the outer os. This area is available for visual examination, cytological and histological examination. However, in some cases, cancer develops in the endocervix and is available for diagnosis only at the invasive stage. In 90-95% of cases, the tumor is represented by squamous cell carcinoma of varying degrees of maturity, in 3-5% - adenocarcinoma.

The clinical picture of cervical cancer is characterized by variability: from an almost asymptomatic course to numerous manifestations, which depends on the prevalence, the nature of tumor growth and its location.

The effectiveness of treatment for cervical cancer directly depends on the timely diagnosis of the process and the correct assessment of its prevalence.

Among the radiation methods for diagnosing cervical cancer, the most informative is the combination of ultrasound and MRI. Modern methods of radiological diagnostics have significantly reduced the frequency of invasive forms and especially advanced stages.

The introduction in recent years of abdominal sensors, Doppler ultrasound and 3D ultrasound has made it possible to dramatically expand the possibilities of assessing the internal structure and vascularization of the cervix, which has led to an increase in the information content of the ultrasound method in the diagnosis of p aka the cervix.

Microinvasive cervical cancer is a tumor of the mucous membrane up to 1 cm in diameter with a depth of invasion from 1 to 5 mm. At the stage of in situ cancer, an increase in the volume of the cervix that exceeds the standard values is determined. The volume of the cervix in cancer in situ is  $8.36 \pm 3.27 \text{ cm}^3$ . The thickness of the endocervix increases, there is an asymmetry in the thickness of the anterior and posterior walls of the cervix or the right and left lateral walls. Asymmetry in wall thickness greater than 3 mm is considered significant for the diagnosis of cancer in situ. The sensitivity of this feature is 73%. Several characteristic echographic features have been described. Sign of "subectocervical rosary" - multiple small cysts in the subectocervical area. The second sign is the presence of hyperechoic inclusions in the subendocervix (B.I. Zykin) and was named by M.N. Bulanov's new feature of "subendocervical pearls".

Tumor detection is facilitated by the use of the energy mapping mode, which allows revealing signs of hypervascularization in the tumor area at the earliest stages of microinvasion. Power Doppler ultrasound in 85% of cases reveals signs of hypervascularization already at the stage of cancer in situ. The degree of invasion into the lateral walls and the extent of the lesion are best assessed in 3D angiography, when gray-scale and vascular images are simultaneously analyzed.

An invasive form of cervical cancer with ultrasound looks like an area of reduced or increased intensity against the background of unchanged layers of the cervical myometrium. An increase in the volume of the cervix of more than  $12 \text{ cm}^3$ , a change in shape to spherical, an asymmetry of the wall thickness, a violation of the integrity of the contours of the endocervix, deformation and expansion of the cervical canal and the presence of a soft tissue component in it are determined.

When performing radical hysterectomy, the main task of ultrasound diagnostics is to identify the involvement of parametria in the process. In the latter case, violations of the integrity and deformation of the contours of the cervix are revealed, with the presence of pronounced vascularization in the tissues of the parametrium around the cervix.

The ultrasound method has limitations in recognizing the pronounced spread of cervical cancer. So, when the tumor spreads to the vagina, the transvaginal examination is not carried out, and the transrectal one also has its limitations due to sharp pain. In addition, transabdominal access does not provide adequate permission. Three-dimensional angiography of the cervix, performed in the early post-radiation period, also helps to assess the effectiveness of treatment and predict the presence of recurrence of cervical cancer [20]. The use of 3D ultrasound in monitoring radiation therapy for cervical cancer is promising and promising. 3D ultrasound in combination with angiography allows monitoring changes in the volume of the tumor and cervix during treatment, the degree of vascularization of the cervix. A decrease in the degree of post-radiation hypervascularization is an important criterion for the effectiveness of radiation therapy in the post-radiation period.

Analysis of the data of modern literature shows that complex ultrasound using energy Doppler mapping and subsequent three-dimensional image reconstruction is a highly informative method that

can be used to screen for changes in the cervix, and also allows you to obtain objective information about the dynamics of treatment of the identified changes. The ultrasound angiographic picture of changes in the cervix improves the quality of diagnostics at all stages of treatment and allows predicting the course of the disease.

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