ULTRASOUND DIAGNOSTICS PARAMETERS OF UTERINE PATHOLOGIES IN COWS

ANNOTATION

Excessive exploitation of highly productive cows affects the reduction of reproduction and the development of obstetric pathology. In these conditions, it is necessary to carry out timely diagnostic and therapeutic procedures. Ultrasound scanning is a modern and effective diagnostic method, both in determining pregnancy and for detecting the pathological condition of the genitals in cows. Determination of new diagnostic parameters increases diagnostic efficiency. To achieve this goal, determination of parameters of ultrasound diagnostics of uterine pathologies in cows, 59 Holstein-Frisian cows were examined with a portable ultrasound scanner using B-mode, with a linear sensor with a frequency of 5-7 MHz. As a result of the conducted studies, the following diagnostic parameters were determined: intrauterine exudate (IUE) depending on the amount and nature (hyperechoic-HE↑, hypoechoic-HE↓), structural changes in the walls of the uterus, hyperechoic white thickened strip, hyperechoic inclusions in the basal layer of the endometrium – foci of fibrosis, calcification, uneven contours of the endometrium (strips of heterogeneous thickness - SHT), the presence of pathological contents in the uterine cavity in the form of white hyperechoic inclusions (snowstorm). In 79% of the cows studied, the presence of intrauterine exudate was determined (IUE - hyperechoic - HE↑, hypoechoic-HE↓), 7.9% had structural changes in the form of thickening of the uterine walls, 62.8% had hyperechoic strips of heterogeneous thickness (SHT) and 54% had a snowstorm.

Key words: cows, ultrasound diagnostic, endometritis, obstetric pathology, diagnostic parameters.

Introduction. To date, there are many techniques aimed at diagnosing the condition of the genitals. However, they differ in a number of features, have variable specificity and reliability.

For a long time, the generally accepted method of diagnosing the condition of the genitals was clinical, including external (visual inspection, palpation) and internal (vaginal and rectal) [1], as well as laboratory (examination of blood, urine, mucus) methods [2,3].

At the same time with the clinical examination of the genitals, the biophysical method of ultrasound diagnostics, which was originally used to determine the pregnancy of females, actively used in recent decades [4].

The ultrasound scanning method makes it possible to differentiate the degree of involution in both healthy and cows with obstetric pathology and has practical value in more accurate diagnosis of uterine involution processes. [5]. There is a relationship between delayed uterine involution, bacterial growth and
an increase in the amount of fluid in the uterine lumen, an increase in the diameter of the horns and cervix and echotextural changes during ultrasound examination [6].

For transrectal ultrasonography, linear transducers in real-time with B mode are most commonly used [7]. High frequency transducers used for transrectal imaging (5 or 7.5 MHz; 1 MHz = 1 x 10^6 sound waves per second) have high resolution and identify objects up to 1-2 mm in size, but have low penetrating power [8].

In cows with clinical endometritis, the uterine cavity is filled with fluid with an increased echogenic structure or anechogetic with an inhomogeneous echostructure, the endometrial layer is thickened and its wall is heterogeneous, and the muscular one is thinned, the boundary between the layers is weakly expressed [9].

In chronic purulent-catarrhal endometritis, relative to the muscular and serous membranes, the mucous layer is clearly visualized, in which foci of increased echogenicity are recorded, indicating areas of proliferative degeneration of the mucous membrane. The lumen of the uterine horns in healthy cows is constricted, half open in some images and contains anechoic contents. In completed involution, the uterus is localized in the pelvic cavity and has a homogeneous echographic structure throughout [10].

The authors note the high efficiency of diagnostics at 4-5 weeks of the postpartum period [11]. The technique of transrectal ultrasound diagnostics of the uterus and ovaries consists in examining through the rectum. To obtain clear visualization, the rectum must be cleared of feces, then the rectal probe is inserted rectally and moved cranially to the lower rectum. For correct interpretation, it is necessary to know the anatomical location of the organs. When the transducer is moved cranially, the bladder neck and the bladder itself are visualized [12, 13, 14].

According to the literature data, the main parameters of ultrasound diagnostics, which determine the state of the genital organs in the postpartum period, are the size of the uterus and ovaries, the size of the cervix, the presence of fluid of various echogenicity in the uterus, structural changes in the walls of the uterus and impaired blood flow in the uterus. The method of transrectal ultrasound diagnosis of postpartum pathologies in cows shows high efficiency, but most often in combination with clinical and cytological studies [15].

To date, there is no gold standard for ultrasound diagnostics of the uterus. Basically, the authors write that the criterion for diagnosis is the presence of symptoms of uterine lesions, which are characterized by the accumulation of fluid in the uterus, endometrial lesions and changes in the diameter of the cervix [5,16]. The purpose of our research was to determine the parameters of ultrasound diagnostics of uterine pathologies in cows.

**Materials and methods of research.** To achieve this goal, cows (n=59) were examined from 5 to 175 days after childbirth and divided into two groups: clinically healthy and sick. Transrectal ultrasound diagnostics was performed by an obstetric veterinary ultrasound scanner EASI SCAN (BCF Technology Ltd, Scotland), in B-mode, a linear sensor with a frequency of 5 MHz (picture 1).

![Ultrasound veterinary scanner EASI SCAN](image_url)

The study parameters included: manual identification, echographic visualization of the cervix, body and horns of the uterus, determination of the state of the uterine wall, determination of the presence of fluid in the uterus depending on the amount and type (hyper-, hypoechoicity of the contents).

**Results of research.** The use of transrectal ultrasonography to assess the reproductive structures of cattle expands the diagnostic capabilities of practitioners who previously used only palpation through the rectum.
The skills of a specialist in obtaining a clear picture when scanning reproductive organs, the ability to distinguish anatomical orientations and interpret ultrasound images are important. Currently, the issue of determining clear and uniform diagnostic parameters of transrectal sonography remains relevant, especially for determining pathologies in the reproductive organs [20].

The skill of the specialist in obtaining a clear picture when scanning the reproductive organs, the ability to distinguish between anatomical orientations and the ability to interpret ultrasound images are important. At present, the issue of determining clear and unified diagnostic parameters of transrectal sonography remains relevant, especially for determining pathologies in the reproductive organs.

Data analysis showed that specialists with experience in diagnostic studies can determine signs of inflammation not only in the ovaries, but also in the uterus, these include:

- accumulation of fluid in the uterus;
- damage to the endometrium;
- change in the diameter of the cervix.

As a result of the studies, the parameters and signs of ultrasound examination were determined, which define the state of the uterus in cows in the postpartum period, with a more detailed interpretation.

Together with ultrasound diagnostics, temperature and fatness were measured, organoleptic evaluation of the discharge of the vagina was obtained and performed, rectal diagnostics and cytology of vaginal smears were performed. Thus, we determined the parameters of ultrasound diagnostics and carried out a comparative analysis of the data. The results of the studies are shown in Table 1.

Table 1 – Results of the ultrasound picture and signs characterizing the state of the uterus of cows in pathology

<table>
<thead>
<tr>
<th>Research methods</th>
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<th>Intrauterine exudate</th>
<th>Structural changes of the uterine walls</th>
<th>Bands of non-uniform thickness</th>
<th>Snowstorm</th>
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<td>Ultrasound diagnostics</td>
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<td>19 79</td>
<td>5 9,6</td>
<td>15 62,8</td>
<td>13 54</td>
</tr>
<tr>
<td>Rectal diagnostics</td>
<td>52</td>
<td>10 19,2</td>
<td>3 5,8</td>
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According to table 1, in the first 20 days after delivery in 79% (19) cows, the ultrasound picture was characterized by the presence of anechoic contents with hypoechoic inclusions (lochi) in the uterine cavity - intrauterine exudate (IUE). Structural changes in the muscular layer of the uterus in the form of thickening were detected in 9.6% of cows. In 62.8% (15) cows from 20 to 45 days after calving, hyperechoic strips of heterogeneous thickness (SHT) in the endometrium of the uterus (hyperechoic white thickened weight, hyperechoic inclusions in the basal layer of the endometrium – foci of fibrosis, calcification. In 54% (13) cows, the presence of pathological contents in the uterine cavity was determined in the form of white hyperechoic inclusions (snowstorm), which is characteristic of acute postpartum endometritis.

When evaluating the ultrasound picture in cows, the days of the study after calving are important. Since in the first two weeks, during the period of active evacuation and contraction, the uterus will contain fluid. During this period, we can pay attention to the volume of content and the nature of the visualized picture in comparison with the clinical picture, which is actively manifesting in this period.

Two weeks after delivery or more, there should normally be no fluid in the uterus, only slight mucus. Ultrasound scanning allows you to detect the contents in the uterus during this period, in the absence of clinical manifestations of pathologies. Here, during the examination, we should also pay attention to the thickening of the walls of the uterus and the visualized picture, which will allow us to differentiate the nature of the exudate.
Based on the results obtained and based on the data of other scientists Sheldon [17], Kasimanickam [18], Kähn [13], Serebritsky [19], we propose to include in obstetric practice the following parameters of ultrasound diagnostics that determine the pathological state of uterine inflammation:

1) intrauterine exudate (IUE): depending on the number and nature (hyperechoic-HE↑), hypoechoic-HE↓);
2) structural changes in the walls of the uterus;
3) hyperechoic white thickened strip, hyperechoic inclusions in the basal layer of the endometrium - foci of fibrosis, calcification, uneven contours of the endometrium (strips of heterogeneous thickness - SHT);
4) the presence of pathological contents in the uterine cavity in the form of white hyperechoic inclusions (“Snowstorm”).

Depending on the nature of the fluid in the uterus, the ultrasound picture has distinctive features, it can be physiological mucus, blood clots (black), lochia after childbirth, pathological purulent-catarrhal and fibrinous exudate (gray, white), delayed and decomposing lochia (areas of gray with white inclusions). In this case, when scanning, it is necessary to take into account the days after childbirth and clinical manifestations.

In the normal course of the postpartum period, by day 7, it is visualized: an increase in the lumen of the uterus, since the uterus is still in the process of involution, a little hypoechoic fluid. The inner layer of the uterus is uneven; the involution continues (Figure 1).

Figure 2 shows insignificantly intrauterine fluid (1) in the uterus of a healthy cow on the 7th day after delivery, cotyledons in the uterus (2). Pathological purulent-catarrhal exudate in the uterine cavity has a high echogenic density; therefore, it is visualized in a lighter color, compared with amniotic fluid or estrus mucus (figure 2).

Figure 3 shows an ultrasound picture of the uterine horn of a healthy cow on the 28th day of the postpartum period (left), where a homogeneous structure of the uterine cavity (1,2) and its wall (3) is visible. A cow with purulent catarrhal endometritis on day 30 in postpartum period have (right) intrauterine exudate (IUE), hyperechoic – 1, structural changes in the uterine wall – 2, bands of inhomogeneous thickness – 3.

The results of the study of the uterus in cows on 10-14 days of the postpartum period (Figure 4) show that in patients with acute catarrhal endometritis of cows, the following signs are revealed during ultrasound: the presence of white hyperechoic inclusions (b) – 1 (“Snowstorm”), strips of heterogeneous thickness weight (SHT) - 2, structural changes, thickening of the walls of the uterus – 3.
Figure 2 – The uterine horn of a healthy cow on the 7th day of the postpartum period. Longitudinal scanning, schematic representation of an ultrasound image (right)

Figure 3 – Ultrasound imaging of the uterine horns in normal (left) and inflamed (right), transverse plane

Figure 4 – Cow uterus horn on the 14th day of the postpartum period, longitudinal scan

Figure 5 – The horn of the uterus of a sick cow on the 25th day of the postpartum period
The results of studies of the uterus in a cow on the 25th day of PRP (Figure 5) showed that in animals with purulent-catarrhal endometritis, the following signs were found, these are IUE in the form of a hyperechoic area - GE (1) and gray hyperechoic inclusions - “Snowstorm” (2), hyperechoic strips of heterogeneous thickness (3) (SHT). Hyperechoic intrauterine exudate, which was collected from the vagina, was a thick white mucus with inclusions characteristic of purulent-catarrhal endometritis (4).

When examining a sick animal on day 41 of PRP (Figure 6), intrauterine exudate (IUE) is visualized in the uterine cavity - 1, hyperechoic inclusions “Snowstorm” - 2, structural changes in the walls of the uterus in the form of thickening - 3.

The results of our studies show that the effectiveness of ultrasound scanning in detecting the norm or pathology of the genital organs increases if it is carried out from 20 to 30 days after calving, as well as at a later date to determine chronic endometritis, when clinical signs do not appear.

The parameters of ultrasound diagnostics of the uterus in cows in the postpartum period are based on the presence of pathological intrauterine exudate and its properties, and structural changes in the myometrium and endometrium of the uterus.

**Conclusion.** As a result of research, the parameters of ultrasound diagnostics of uterine pathologies in cows were determined, such as the presence of intrauterine exudate (IUE - hyperechoic - HE↑, hypoechoic-HE↓) in 79%, structural changes in the form of thickening of the uterine walls in 7.9%, hyperechoic strips of heterogeneous thickness (SHT) in 62.8% and snowstorm in 54% of cows. The effectiveness of ultrasound scanning in detecting the norm or pathology of the genitals increases if it is carried out from 20 to 30 days after calving, as well as at a later date to determine chronic endometritis when clinical signs do not appear.

**REFERENCES**

ТУЙІН

Жогары өнімді сиырларды қарқынды пайдалану кезінде, репродуктивті функцияның томендеуі және акушерлік патологияның айтарлықтай таралуы байкалды. Бұл жағдайда уақытылы диагностикалық және емдік процедуралар кәжет. Ультрадыбыстық сканерлеу бузадықты анықтауда да, сиырлардың ұясыныс мүшелерінің патологиялық жағдайлары анықтауда да заманауи және тіімді диагностикалық едіс болып табылды. Диагностикалық жағдайлар диагностикалық тіімділік арттырады. Сізге жету үшін сиырлардан алуға арналған ультрадыбыстық диагностикалық патологияның анықтау үшін 59 голштейн-фриз сиыры және 5-7 МГц жиіліктегі сызықтық сенсоры бар

В режимінің колданатын портативті ультрадыбыстық сканер жүргізілді. Нәтижесінде, жатырдың қабынуының патологиялық жағдайына қарай, жатырдың қабырғаларының құрылымдық өзгерістері, гиперэхогендік-ге↑, гипоэхогендік-ГЭ↓, жатыр қуысының ақ гиперэхогендік қосындылар (метель-М) түрінде патологиялық түрде болуы. Зерттелген сиырлардың 79% - да жатыршілік экссудаттың болуы анықталды (ЖІЭ - гиперэхогенді - ge↑, гипоэхогенді-GE↓), 7,9% - да жатыр қабырғаларының құрылымдық өзгерістер, 62,8% - да гетерогенді біркелкі емес қалыңдықтағы жолақтар (БҚЖ) және 54% - да.

РЕЗЮМЕ

При эксплуатационной нагрузке на высокопродуктивных коров, наблюдаются значительное снижение воспроизводительной функции и значительное распространение акушерской патологии. В этих условиях существует необходимость своевременных диагностики и лечебных процедур. Ультразвуковое сканирование является современным и эффективным методом диагностики, как в определении стельности, так и для выявления патологического состояния половы органов у коров. Определение новых параметров диагностики позволит повысить диагностическую эффективность. Для достижения поставленной цели, определение параметров ультразвуковой диагностики патологий матки у коров, произведены 59 коров голштейн-фризской породы и портативным ультразвуковым сканером с использованием B-режима, с линейным датчиком с частотой 5-7 МГц. В результате исследований определили параметры ультразвуковой диагностики, определяющие патологическое состояние
воспаления матки: внутриматочный экссудат (ВМЭ) в зависимости от количества и характера (гиперэхогенного-ГЭ↑), гипоэхогенного-ГЭ↓), структурные изменения стенок матки, гиперэхогенная белая утолщённая полоса, гиперэхогенные включения в базальном слое эндометрия – очаги фиброза, кальцинова, неровные контуры эндометрия (полоски неоднородной толщины - ПНТ), присутствие патологического содержимого в полости матки в виде белых гиперэхогенных включений (метель-М). У 79 % исследуемых коров определили наличие внутриматочного экссудата (ВМЭ - гиперэхогенный - ГЭ↑, гипоэхогенный-ГЭ↓), у 7,9 % структурные изменения в виде утолщения стенок матки, у 62,8 % гиперэхогенные полоски неоднородной толщины (ПНТ) и у 54 % метель.