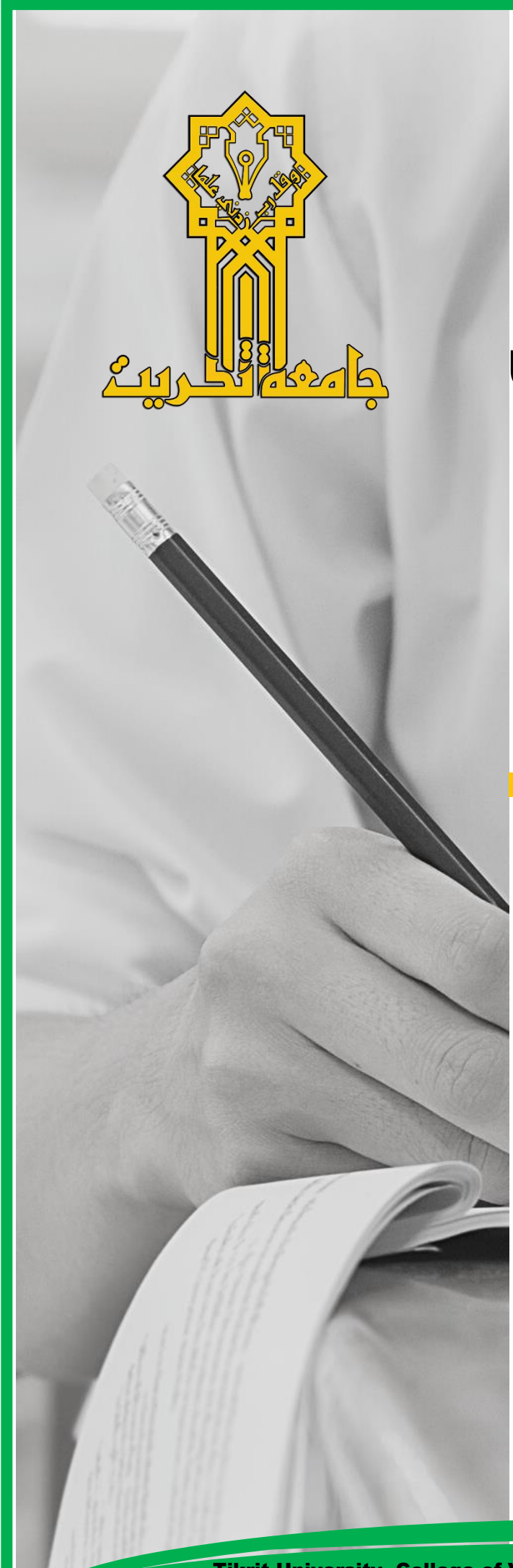

Tikrit University
College of Veterinary Medicine

Ultrasonography

Subject name: Reproductive techniques

Subject year:5

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Ultrasonography

Ultrasonography was started to use In veterinary on the 1980 for diagnosis of pregnancy at the earliest gestational stage.

Ultrasonography can be defined as high frequency sound waves above the audible range 20,000 Hz. The frequency of these sound waves is described in cycles per second, or hertz (Hz). The picture that the ultrasound produce on the monitor was in different shades of white and black, Ultrasonic echoes that appear on the screen differ from black to white according to the degree of ultrasonic wave reflection Liquids, such as in the embryonic vesicle and ovarian follicles, was not reflect sound waves; they usually appear black and are described as non echoic, ultrasonic images for solid tissue, such as bones and the ruminant cervix, , show white due to the reflection of most sound waves and were described as echogenic or hyperechogenic. Images of soft tissues usually had varying gray shades. The urinary bladder is the landmark for ultrasonic examination of reproductive genital tract.

Ultrasonography examination trans-rectal in early pregnancy and Transabdominal in advance pregnancy, and has been used more frequencyfor pregnancy diagnosis .

Types of Ultrasonography systems

1 A-mode ultrasound (Amplitude-depth or echo-pulse)

In this system, the transducer containing one crystal emits ultrasound waves which penetrate the tissues under the skin and reflect when meet a high acoustic impedance interfaces (pregnant uterus or fluid-filled structures). The transducer receives the reflected echoes and converts them into peaks on oscilloscope with horizontal range representing the depth of the reflecting structure or into audible signal or to easy to hear signal.

A-mode ultrasound is quick and simple technique for diagnosis pregnancy, but it cannot predict the fetal number and the viability of fetus.

2 - Doppler ultrasound methods

The Doppler ultrasound Investigation of the uterine and umbilical arteries gives information on the perfusion of the uteroplacental and fetoplacental circulations,

Doppler devices used to detect the fetal heart beats and flow of blood in uterine and fetal vessels.

Pregnancy diagnosis with doppler ultrasonography can include movements as an indication of pregnancy such as fetal heart beat, fetal circulation and fetal movements, Fetal blood flow is the most diagnostic feature. Fetal pulse which is faster than maternal pulse or fetal movements are all positive criteria for pregnancy.

Real time (B- mode Ultrasonography or B- scan)

B-mode or real-time ultrasound has become the preferred means of pregnancy diagnosis for small ruminants and other species. B-mode ultrasonography is an accurate, rapid and safe method for diagnosing pregnancy in small ruminants .

The Ultrasound system formed from two main part

1. Main Unit: The main unit formed from five main part

1- Timer

2- electrical pulse Generator

3-Receiver

4- digital scan converter

5- monitor

2- probe or transducer

The probe is responsible for sending and receiving the sound signals while the screen converts the sound signal into an electrical signal, which is in the end viewed on the screen.

The probe classified two type according to the picture appeared . **1-**

Linear probe

The picture appeared (Rectangular image) ,the linear probe used to early pregnancy diagnosis, ovary examination ,and testis examination in male.

2. Sector probe

The picture appeared (Sector image) like Slice of pipe ,also the probe easy in using .

Also the probes classified two type according to the Ultrasonography frequency.

1- probe with low frequency (from 3 to 3.5)MHz

2- probe with high frequency (from 5 to7.5) MHz

Aliner Array tranduser (5MHz) rectagular image, good resolution, inter mediate depth (0-10cm) were used for pregnancy diagnosis and determination of fetal sexs. and linear array prostate tranducer(7.5MHz) reduced field depth (0-7cm) ,higer resolution was used to observe follical and corpus lutum, early pregnancy diagnosis,detrmination of fetal sex.and probe with best depth (0-20cm) lower resolution was used in advanced gestationand (3.5MHz).

Reproductive Ultrasonography

1) Ovarian structures Follicles are fluid-filled structures that appear black. The corpus luteum is a heterogeneous tissue, which appears medium gray.

2) Uterus

Fetal viability can also be determined by Ultrasonography depended on the heart beats of fetus and movement .

Sex detection : Male - scrotal swelling, fetal prepuce beside umbilicus.

Female - lack of male structures and appearance of a vulva under the tail.

Use of B-mode Ultrasonography in diagnosis animals reproductive system

Usually, the ultrasonic findings of the pregnant and non pregnant uterus in animal depended The urinary bladder was the landmark for ultrasonic examination of both gravid and non gravid uterus in sheep and goats. the urinary bladder appears as anechoic structure seen trans-rectally as well as trans-abdominal on the floor of the pelvic cavity or caudal abdomen. when animals had been treated for super ovulation, the uterus appears with a fluid accumulation. The uterine wall had homogenous, non-smooth.

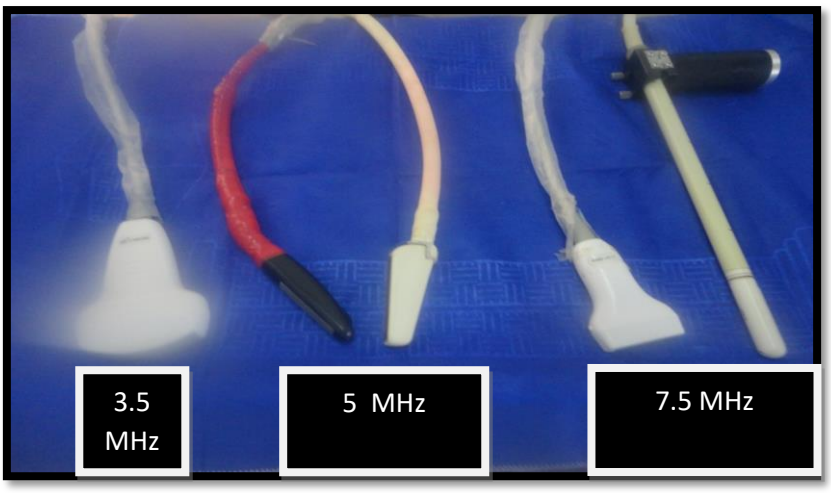
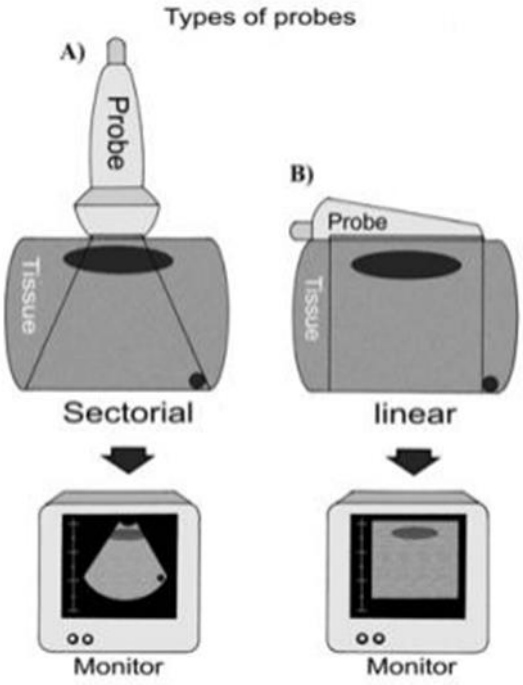


Figure show different probes equipped with the scanner system(3.5, 5, 7.5 MHz).



Types of probes (A = sectorial and B = linear)

Applications of ultrasound in domestic animal reproduction:

1. Assessment of ovarian structures

A. Anoestrus

The stroma of the anoestrus ovary has homogeneous echogenicity on ultrasound examination. Gross structures associated with cyclic activity such as

follicles and corpora lutea are typically not visible. Small, truly anoestrus ovaries are usually only found in young heifers.

B. Active-ovary

The components of the active ovary, including follicles, corpora lutea and ovarian stroma, have various echogenicities and therefore will appear as varying shades of grey on ultrasound examination.

1. Follicles

Antral follicles of various sizes appear as non-echogenic structure. However, it is not usually possible to distinguish the follicular wall from the surrounding stroma (apart from large pre-ovulatory follicles). Follicles do not always appear round due to transferred pressure from the transducer on the surrounding ovarian tissue. Diameter of the individual ovulatory follicles was measured by transrectal ultrasonography at AI and ranged from 8 to 30 mm.

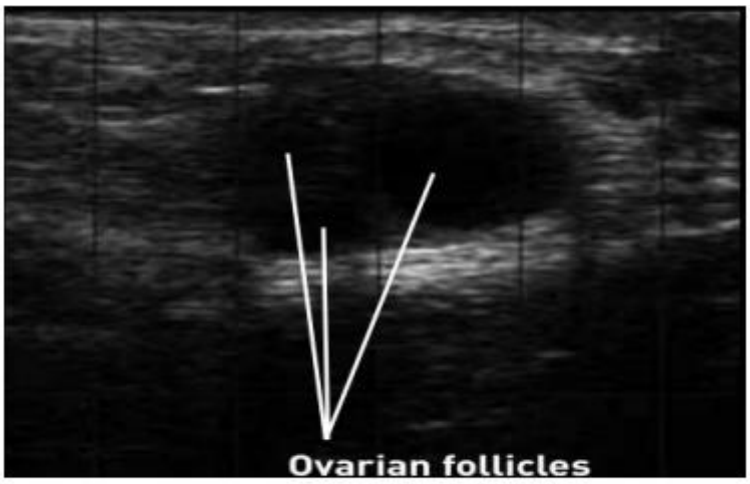


Fig. 6: Bovine Ovary with follicles

2. Ovulation

Ovulation was depicted by the absence of a preovulatory follicle that was present at a previous examination and subsequently confirmed by the development of corpus luteum at the same spot. The usefulness of ultrasonography performed at 2-hourly intervals for detecting the onset of ovulation.

3. Corpora lutea

Generally, a CL is identified ultrasonically from the third day after ovulation. A developing CL appears on the ultrasound image as a poorly defined, irregular, greyish-black structure with echogenic spots all within the ovary "central lacuna (fluid-flledcavity)" a mid-cycle CL is a well-defined granular, greyish echogenic structure with a demarcation line visible between it and the ovarian stroma; in a regressing CL the demarcation line is faint, owing to the slight difference in echogenicity between the tissues. Compared to a luteal cyst, a normal CL with a central lacuna is less than 25 mm in diameter and the lacuna occupies less than one third of the entire CL.

Additionally, persistence of the CL may assist in the determination of early pregnancy diagnosis. The embryonic vesicle can usually be found in the uterine horn ipsilateral to the ovary containing the CL.

In small ruminants such as goats, where we cannot examine ovarian structure through palpation per rectum, ultrasound is the best method for monitoring ovarian activity as mentioned.

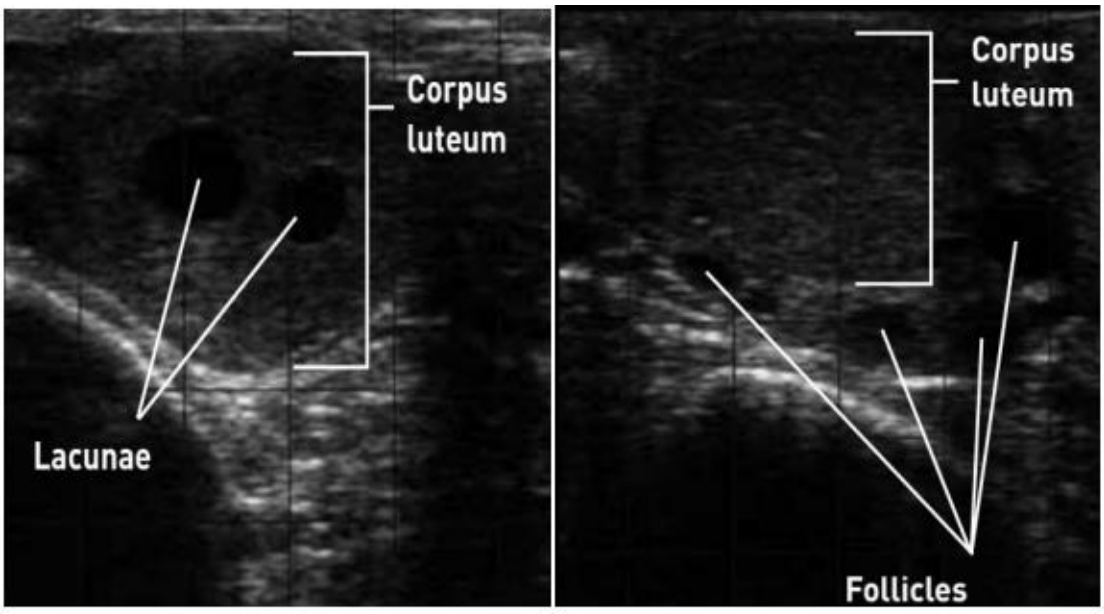


Fig. 7: L. CL with lacunae **R.** CL with follicles

2. Assessment of Uterus

2.1. Non-pregnant uterus

The uterus has different echogenic appearances depending on the stage of the oestrous cycle. Viewing the uterine horn in cross section, where the uterus is circular in appearance may enable the endometrium, myometrium and uterine lumen and its contents to be identified more easily.

When the cow is in oestrus, the endometrium becomes oedematous and therefore the endometrial folds become more prominent. The lumen also has a varying appearance depending on intraluminal fluid accumulation at different stages of the cycle. In the per-ovulatory period, the uterine lumen appears anechoic due to mucus accumulation. It is important to differentiate between the appearance of a large amount of mucus in the uterus and early pregnancy. This can be done throughexamination of the ovaries for the presence of follicles and corpora lutea in addition to the presence/absence of a foetus, foetal membranes and placentomes (cotyledon/caruncle unit).

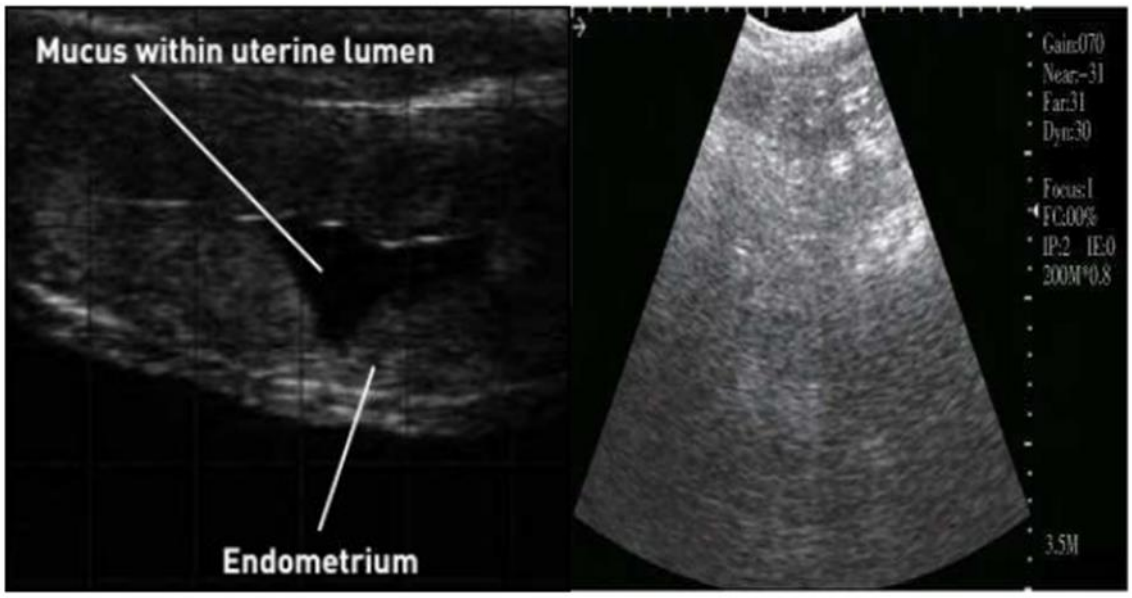


Fig. 8: L. Non-pregnant uterus (during pro estrus and estrus stage) **R.** Transabdominal ultrasonographic image of non-pregnant cow, there is no anechogenic areas of fetal fluid.

2.2. Pregnant uterus

The experienced operator may be capable of detecting a pregnancy as early as day 17 post-breeding/ artificial insemination (AI), most operators can diagnose

pregnancy under farm conditions quickly, easily and accurately by day 30 through the use of transrectal ultrasonography. Therefore, it is generally advisable to perform ultrasound examinations for pregnancy diagnosis around day 30 post-breeding/AI. A positive diagnosis of early pregnancy may be made without visualization of the embryo on ultrasound examination.

This is done through identification of allantoic fluid, foetal membranes and placentomes.

The concepts appears as an echogenic structure inside a non-echogenic structure. This done by using transrectal probe. Early pregnancy diagnosis can improve reproductive performance by decreasing the interval between successive artificial insemination services and coupling a non-pregnancy diagnosis with an aggressive strategy to rapidly rebreed the animal.

2.2.1. Determination of foetal age.

Estimation of foetal age, monitoring of foetal growth across time and diagnosis of pregnancy disorders can be performed by ultrasonography foetometry. Biparietal diameter of the skull, crown rump length and long bones length can be used to estimate gestational age.

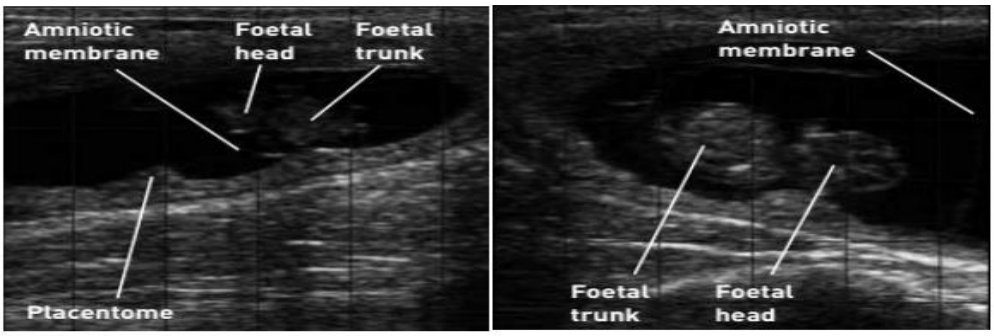
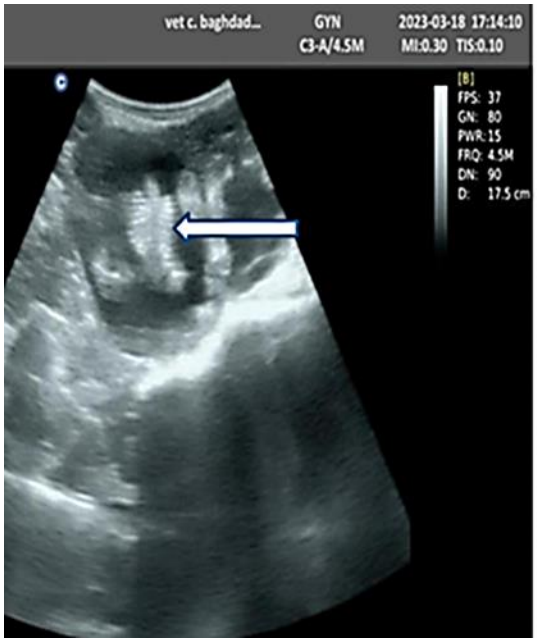


Fig. 10: L. 42-day pregnancy **R.** 45-day pregnancy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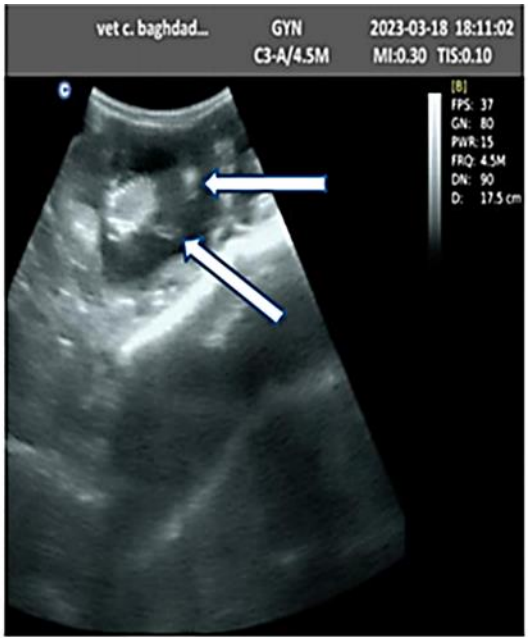
D: 17.5 cm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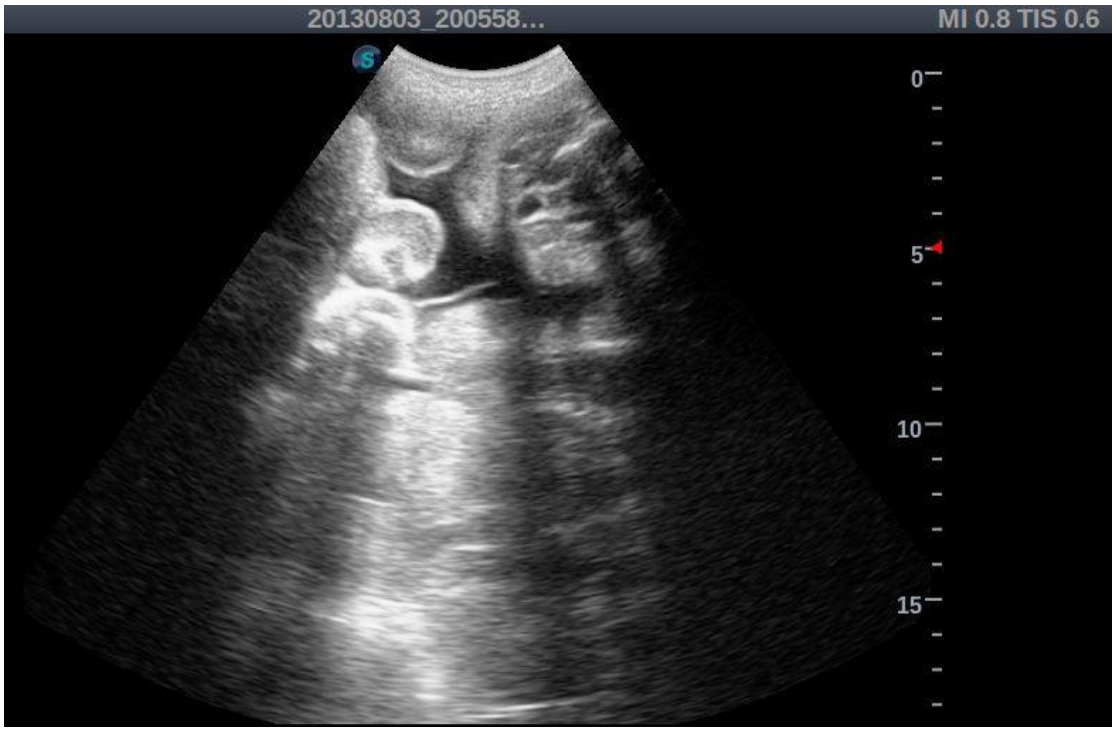
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