

Early pregnancy diagnosis

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The use of an ultrasound device to diagnose pregnancy may be an alternative to a *per rectum* clinical examination. In case of the exclusion of early pregnancy it allows to introduce appropriate treatment faster and as a result, it has an influence on the shortening of the production cycle.

Anticipating increased demands of animal breeders, field veterinarians are looking for new and more effective diagnostic methods. The use of an ultrasound device for pregnancy diagnosis may be an alternative to a *per rectum* clinical examination. In case pregnancy is early excluded, it allows to introduce treatment faster and as a result, it has an influence on the shortening of the production cycle.

An ultrasound examination allows for example to visualise foetal structures in a short time after insemination. Moreover, it is helpful to estimate such parameters as: foetal vitality, diagnosis of twin pregnancy, identification of foetal sex as well as the dynamics of changes in the area of the uterus and ovaries during oestrus and pregnancy. The ultrasound devices whose probes are equipped with puncture needles are also used during the procedures of oocyte pick-up (OPU) for in vitro production of embryos (IVP).

However, these devices are usually moderately useful in the field due to their large dimensions and quite a high price. At the same time the big majority of them requires mains power supply.

The alternative to stationary ultrasound devices is small portable devices equipped with a linear or sector probe, supplied from an independent power source such as batteries. Several types of such ultrasound devices are available at the national market. They include devices by Ehoson, Honda and Teson. However, their disadvantage at purchase in our conditions is still a price which is too high.

A good example of a compromise between functionality and a price is a miniature ultrasound device Animal Scanner by Dramiński. This device is small and equipped with a battery. It has two sector heads (abdominal and rectal), both at the frequency of 5 MHz. The angle of wave absorption is respectively 90 and 180 degrees, whereas the range of penetration is from 7 to 20 cm. This device is equipped with a display (LCD) with a frequency which is high for this class of devices and the diameter of 6.4 inches. The weight of the device with a battery does not exceed 2.7 kg. (1)

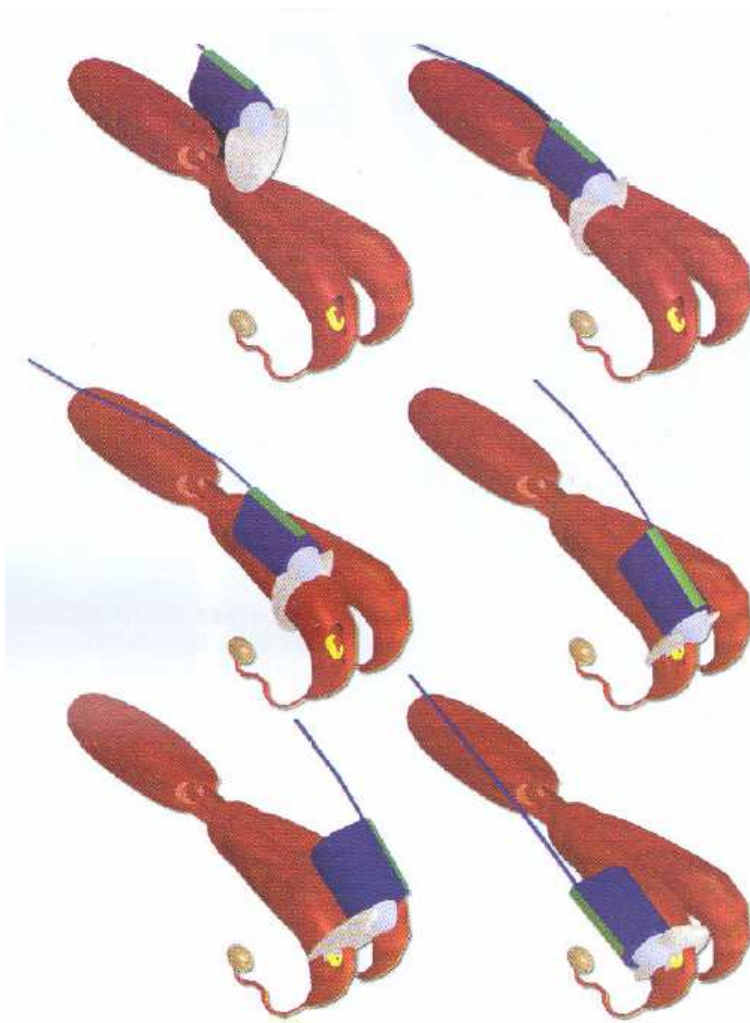
A per rectal examination of cows aimed to diagnose pregnancy is a routine test. It is usually performed between 35 and 42 days after insemination. Pregnancy is diagnosed basing on so called foetal membrane slip. The structure under examination is the foetal bladder which is palpable at 30-32 days of pregnancy. Between 30 and 35 days after insemination it forms an oval of a size similar to a pea seed (5-10mm). It is characterised by quite a solid texture and it slips out of the fingers easily. Its volume is about 60-75 cm³ at that time. (2) The time of a per rectal examination in one cow is short and ranges from 10 to 30 seconds.

Pregnancy diagnosis with an ultrasound device is more time consuming. It usually last 1-2 minutes. However, it allows to determine pregnancy at about 20 days after insemination when compared to a clinical examination (3).

Fig. 1 Graphic illustration of a technique of an ultrasound examination with the Animal Scanner device

Examination technique

Before the beginning of a test the ultrasound device should be protected with transparent foil. This method allows to protect the control panel against animal faeces. The probe of the Animal Scanner is put into a glove indicated for a rectal examination. Orange gloves Super Sensitive by Kruuse are best for that. Green soft gloves (by the same company) are not practical as they are too delicate and they are very prone to rupture during an examination. A finger of the protective glove should be filled with gel. Its optimum amount, namely 4-5 ml should be taken into account.



Too much gel may result in a glove rupture during the examination. The kind of gel used has a significant effect on the quality of an image which is obtained. According to our observations we are surprised to announce that the best gel for such an application is moisturising gel Bovivet by Kruuse. It is not dense liquid with relatively low density. Similar, although slightly worse image quality on the LCD panel was obtained with more dense preparation by Żelpol. The ultrasound head was also placed in a glove filled with 4 ml of Bioakryl; however, with no desired effects.

When faeces are eliminated from the rectum a device head is introduced into the large intestine lumen. Before the probe has been placed on the surface of the uterus an operator should determine by palpation individual parts of an examined organ every time (cervix, corpus, horns). The above action is significant as it decreases the risk that the probe is placed against the uterine artery or a cyst present in the ovaries.

The head should be moved along the greater horn curvature towards an opening of the oviduct, also towards the sides and medially with the relation to its long axis. Taking into account that the image visible on the screen of the Animal Scanner is not real, namely it appears with delay, the ultrasound probe should be moved slowly. Fig. 1 presents a graphic illustration of an ultrasound examination method with the Animal Scanner.

In order to diagnose appropriately it is necessary to enclose an ultrasound picture of the non-pregnant uterus to an ultrasound examination. The section of the horn in the period of sexual silence resembles two, clearly visible (echogenic) tubes and one of them is slipped onto the other. The outer ring of tubes includes the serous and muscle layers of the uterus. The core is created by the mucous membrane of the uterus. Fig. 2 presents an image of the non-pregnant uterus obtained with the use of the Animal Scanner by Dramiński.

Depending on the stage of the oestrus cycle the width of the uterus changes. During oestrus a border between the mucous and muscle layers is clearly visible in an ultrasound image. At that time the uterine cavity contains small amounts of liquid which plays a nutritional function

and it helps the sperm cells during their movements towards the ovum. In the ultrasound image obtained with a sector probe of the Dрамиński device the oestrus fluid is present in the central part of the horn in the form of a non-echogenic spot with the diameter of 1-2 mm. In the non-oestrus period the fluid inside the uterus is not visible. The diameter of the endometrium at that time is significantly lower.

Pregnancy detection

Determination of early pregnancy with the help of a high class ultrasound device equipped with a linear probe is possible at about 10th day after insemination. However, the examination performed in this period is based only on the confirmation of the presence of amniotic fluid in the uterine horn. The accuracy of an early diagnosis between 10 and 18 days after insemination does not exceed 50%, though.

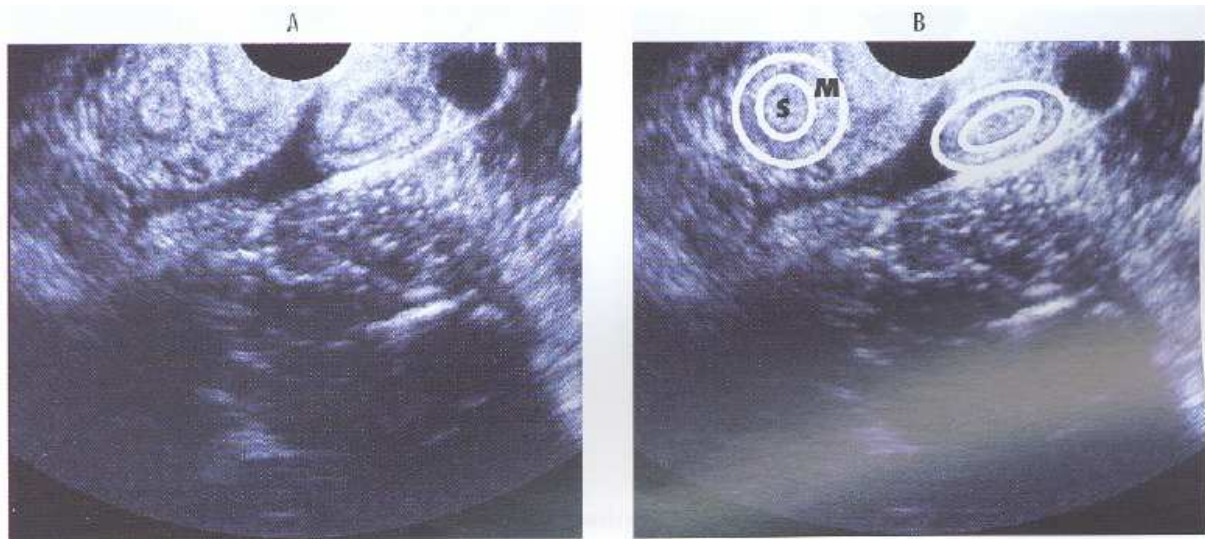


Fig. 2 The image of the non-pregnant uterus obtained with the Dрамиński Animal Scanner device. In the picture B the mucous membrane (S) is visible as well as the muscle layer (M) of the horns of the non-pregnant uterus. Also in the images (in the right upper area) *a. uterina* is visible.

Probably it is due to difficulties in distinguishing non-echogenic fluid which may be present in the uterine lumen during pregnancy as well as oestrus (4). 100% of certainty based on the presence of amniotic fluid can be obtained after 20 days of pregnancy (3). The echogenic structure of the embryonal bladder is well visible at that period. The diameter of the embryo itself is 3.8 mm (from 2.5 to 7 mm) between 20 and 24 days of pregnancy (6). Since 20th day the embryo is visible as a distinct clearly echogenic structure in the form of a short straight line in an ultrasound image. Between 22 and 30 the embryo forms the shape of the letter C and between 30 and 32 days it forms the shape similar to the letter L (5).

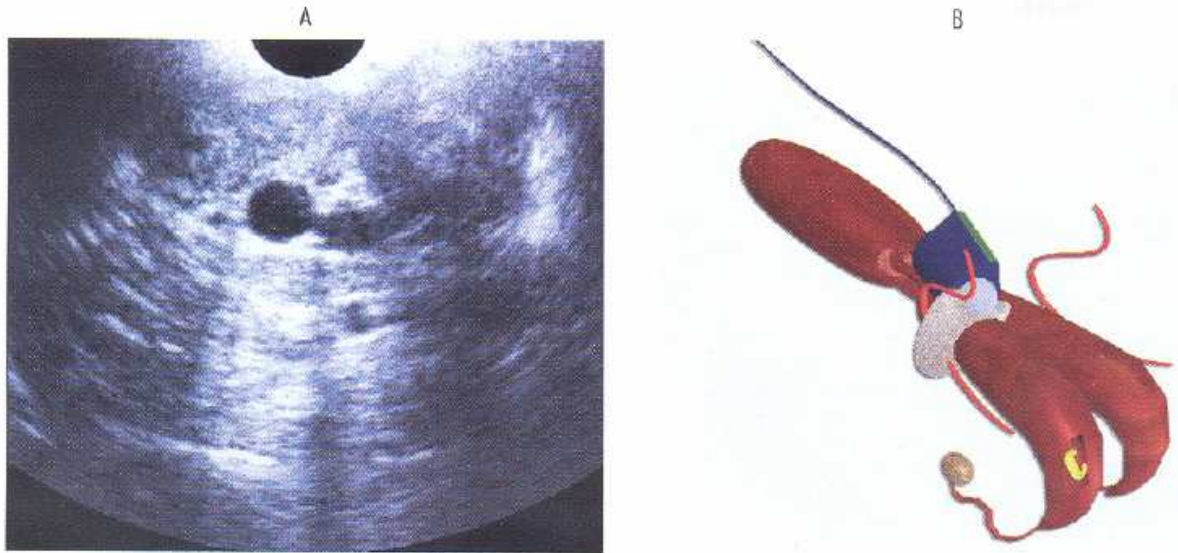


Fig. 3 The ultrasound image presenting a. uterina – (A), a graphic illustration of probe placement on the uterine artery – (B)

The Animal Scanner device equipped with a sector head was used for pregnancy determination since the 25th day after insemination. The attempts to determine foetal presence between 21 and 25 days were not connected with desired effects. The image on a LCD panel obtained before the 25th day was less clear when compared to images obtained with the help of a linear probe.

The possibility of a mistake between 25 and 28 days after insemination is relatively high, especially when a test is performed by an inexperienced operator. For example, in the initial period of tests we diagnosed correctly only 58% of pregnancies. The structure being responsible for an incorrect diagnosis is the uterine artery – at this period its diameter is similar to the diameter of the foetal bladder. Mistaking the uterine artery for pregnancy is significantly rarer at later time as the size of the uterine artery does not change. Fig. 3 presents the uterine artery (A) and the position of a probe where the risk of making a mistake is particularly high (B). The diagnose of 28-day pregnancy may be almost completely based on the presence of the embryo which is in a distinctive contrast to the non-echogenic fluid filling the area in the horn – Fig. 4 presents an image of the pregnant (A) and non-pregnant (C) uterus between 28 and 29 days of pregnancy. On the 29th day of pregnancy the length of the pregnant uterine horn is 18 mm, whereas its width 7 mm. The embryo itself is usually 6 mm long.

The research conducted by the authors on 286 cows so far seems to show that the Animal Scanner device was relatively less unreliable in the diagnosis of 30-day pregnancy. The rate of incorrect diagnoses did not exceed 25% at that day. Fig. 5 presents ultrasound images of the foetal structures on 30th day after insemination. The dimensions of the cavity filled with liquid, inside the pregnant horn are 19 mm x 11 mm on 32nd day of pregnancy. The embryo may be up to 10 mm long. It is possible to notice the limb buds and the foetal head in the ultrasound image.

Pregnancy tests on 35th day after insemination are not difficult to be performed. Echogenic foetal structures are well visible on that day. The limb buds and foetal head are distinctly visible on the majority of ultrasound images. The size of the cavity filled with liquid localised in the uterine horn is 37 x 22 mm, whereas the length and width of the foetus is respectively 19 and 11 mm. Fig. 6 shows an ultrasound image of the pregnant uterine horn with a clearly visible foetus.

Taking everything into account, the use of the Animal Scanner by Dramiński may be helpful in everyday field practice. A relatively reliable pregnancy diagnosis is possible since the 25th day after insemination. This device might also be useful in case of doubts which may be faced by a veterinarian during clinical pregnancy diagnosis.

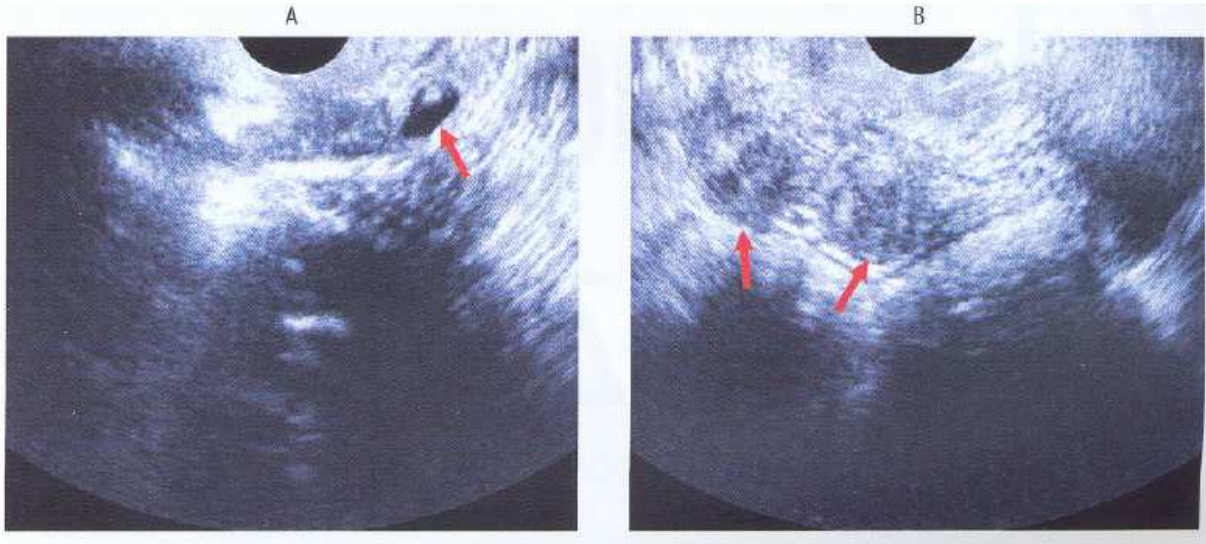


Fig. 4 An image showing a pregnant horn on 28th day (A), the image of a non-pregnant horn on 29th day (B)

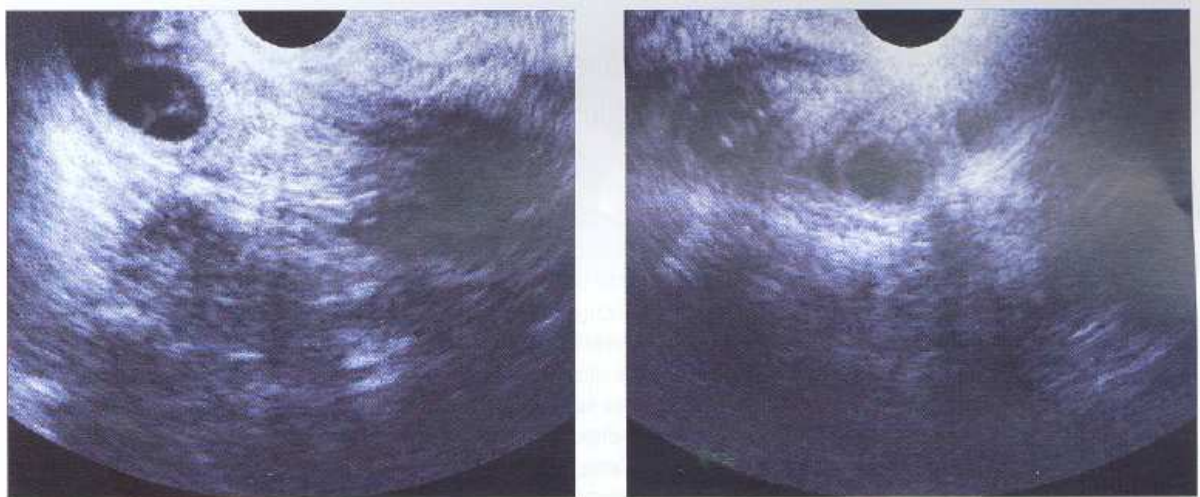


Fig. 5 Ultrasound images of a pregnant uterus on 32nd (A) and 33rd (B) day of pregnancy

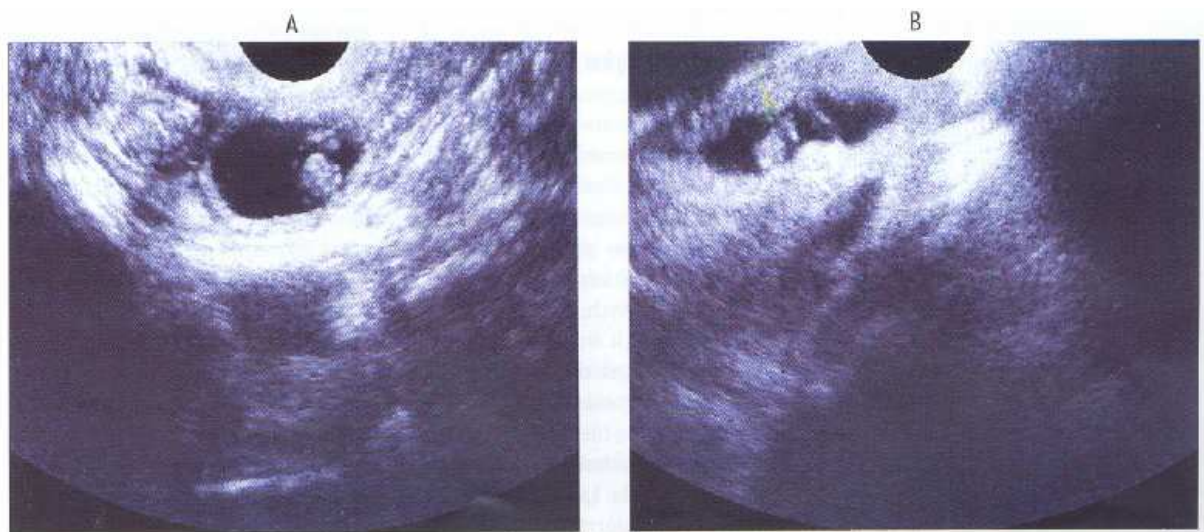


Fig. 6 Images of a pregnant uterine horn with a clearly visible foetus (the test performed on 35th (A) and 39th (B) day after insemination, respectively)

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