HOW TO USE TRANSRECTAL ULTRASOUND EXAMINATION TO MONITOR LATE PREGNANCY IN THE MARE

Introduction

Transrectal ultrasound examination is a tool that is commonly used in mares for breeding management and pregnancy detection. Transrectal ultrasound examinations of the reproductive tract are typically performed throughout the estrous cycle and for the first 60 days of gestation. Late gestational pregnancy examinations are performed less frequently. However, regular monitoring of the mid to late gestational mare provides important information about feto-placental unit and fetal well-being, which may aid in early diagnosis of conditions such as placentitis. By implementing late gestational ultrasound evaluation, the practitioner provides the mare owner with good information that is often useful for the delivery process.

Materials and Method

The procedure for ultrasound examination of the late pregnant mare is similar to the technique used in mares for breeding management. The equipment required is a portable ultrasound machine with a multi-frequency linear probe (5-7 MHz) that is routinely used by a veterinarian to manage the estrus cycle or to detect early pregnancy. Mares can be examined in stocks or adequately restrained in a stall. After the rectum has been emptied, the probe is gently introduced trying to advance as much as possible in order to catch more details. The pregnancy is then carefully monitored, changing the settings of the probe depending on the depth of the structures that have to be examined. As the probe is withdrawn it can be moved side to side to providing a complete examination of the reachable parts of the fetal body and membranes. The ultrasound examination is completed at the cervical area and the cervix is visualized and assessed. The late gestational transrectal ultrasound examination must be carried out carefully since the cranial portion of the fetus and the front legs are often in the pelvic area. It should be very useful to record videos of the ultrasound examinations to carefully recheck and interpret the images and to collect useful data.

Transrectal ultrasound examination of the pregnant mare allows the evaluation of different structures, depending on the gestational stage. We recommend regular examinations starting at sixty days control in order to confirm the pregnancy and to determine the sex of the fetus. Further examinations for a normal (not high risk) pregnancy are routinely carried out at 4 - 7 - 10 months of gestation. If the client agrees, we perform extra examinations at 5 months and 9 months of gestation, concurrent with the first and third prophylactic vaccinations for Equine Herpes virus I. Transrectal ultrasound examination of the mare around 4 months of gestation can reveal important information about the fetal well-being, in fact, regardless of the fetal presentation, it is possible to determine or confirm the fetal sex and to monitoring the entire fetal body which allows evaluation of organs for potential disease or malformation (Fig.1). To do that, once the head of the fetus has been visualized it is possible, gently moving the probe from side to side and proceeding backward or forward, to assess neck and thorax cavity where heart and lungs are easily recognizable. The arched line of the diaphragm separates the thorax from the abdomen (Fig 2), where, in the cranial portion stomach, liver and spleen can be seen (Fig 3), while in the caudal part intestine, kidneys, gonads and bladder can be identified. (Fig 4) In order to determine the fetal sex at this stage of gestation, besides to the different features of the gonads, it is possible to identified penis, prepuce, urethra and scrotum in the male foetus (Fig 5) and mammary gland, teats, vulva and clitoris in the female foetus (Fig 6).

At this stage of gestation the umbilical cord is easily assessed and using color Doppler technology it is possible to assess the blood flow within the umbilical cord (Fig. 7). Blood flow can be traced using spectral Doppler ultrasonography.; the spectral waveform, obtained by combining the Doppler velocity signals displayed against time, is composed by a systolic and diastolic components from which several indices can be measured. The Resistance Index (IR) supplies information about the perfusion of the district downstream the measurement site.

Other structures like the remnant of the yolk sac (Fig.8) or urachus enlargement (Fig. 9) can be identified by transrectal ultrasound examination. After 5 months of gestation, due to the size of the fetus,
the usefulness of transrectal ultrasound examination to assess fetal structures is limited to the cranial or caudal part of the fetal body, depending on the presentation of the fetus. Fetal heart rate, a good indicator of fetal wellbeing, can be assessed transrectally until 5-6 month of gestation by M-mode. The cervix can be evaluated using transrectal ultrasonography throughout the gestation. Placentitis in mares is reported to be most commonly caused by bacteria ascending through vagina and cervix, then is obvious how is important to assess the cervical echo-texture, in particular any change in echogenicity of the central mucosa.  

A technique that is commonly used by veterinary practitioners is assessing the caudal portion of the utero-placental unit which is referred to as the Combined Thickness of Uterus and Placenta (CTUP). It is important to start looking at CTUP at mid-stage of gestation; especially in mares with a poor breeding history, as ultrasound examination of the utero-placental unit can identify placental pathology before the onset of clinical signs and before abortion or premature delivery occurs. The CTUP is easily measured in the ventral portion of the uteroplacental unit immediately cranial to the cervix, where an anechoic vascular structure runs underneath the uteroplacental unit, and clearly highlights the area. (Fig. 10) The CTUP increases slowly between 4 and 9 months of gestation from approximately 4 to 7mm. After 7 months, the CTUP increases significantly until term and published measures are available for each gestational month thereafter. The ultrasound appearance of the uteroplacental unit at this stage is uniformly echogenic and it is difficult to distinguish the uterus from the chorioallantois. Evaluation of the amniotic and allantoic fluids can also be performed at this time. The allantoic fluid is usually anechoic while the amniotic fluid is more echogenic and contains a varying amount of small floating particles. The particles in the allantoic fluid increase due to the movements of the fetus, which is in close contact to the amnion. While the increasing echogenicity of the amniotic fluid has to be considered abnormal if not related to fetal activity, the uniform increased echogenicity of the allantoic fluid should be suspected as a sign of ongoing disease. Also the increasing of the fetal fluids in case of Hydroallantois or Hydroamnion can be visualize by transrectal ultrasound examination.  

The combination between transrectal ultrasound examination and Doppler technology allows to monitoring the uterine blood flow throughout the gestation. Spectral Doppler is helpful to evaluate the blood flow from both uterine arteries; total blood flow, pulsatility and resistance indices can help to detect abnormal uterine blood supply. In normal pregnancies the resistance index decreases during pregnancy, while the total blood flow rises in particular starting from 7 months of gestation, the timing and the pattern of these changes are correlated with placental and fetal development. By transrectal ultrasound examination at 7 months of gestation, only the caudal part of the pregnancy can be monitored but useful information is gained. Not only can the cervix and fetal fluids be evaluated, but examination of the CTUP is critical from this time period forward as this is the period when placentitis occurs. The ultrasound appearance of the uteroplacental unit is usually uniformly echogenic and the CTUP measures approximately 4-5 mm. An increase in CTUP along with edema of the allantoic layer is often a symptom of a pathological situation such as placentitis (along with mammary enlargement or vaginal discharge). Placentitis more frequently occurs in the last trimester of gestation causing abortion, premature births or foals losses within the first 24 hours of life . Transrectal ultrasound examination of the uteroplacental unit is the key to identify placental separation in the area (Fig. 11), which is usually associated to hyper acute ascending placentitis. From this time and until term, the movements and the position of the fetus may affect the feature of the uteroplacental complex around the cervix which can take a folded appearance (Fig. 12) that makes challenging to get an accurate CTUP measurement. In that case is necessary to wait for fetal movements stretching the cervical pole. Another variation of the ultrasonography appearance of the allantois which can be detected at this stage of pregnancy and up to term, is represented by the ectasia of the allantoic vessels (Fig. 13) that may occur to be large in numbers and size with no effects on fetal well-being, but can also appear in case of partial torsion of the umbilical cord or caudal presentation of the fetus and it is usually associated to edema of the uteroplacental unit. The amnios can be evaluated and it appears as a thin echogenic floating membrane throughout the gestation that may slightly thicken at term without any effect on fetal well-being. In case of amnionitis, the membrane may thicken more clearly. The heart rate measured by M-mode, is a good indicator of fetal well-being and all hearth beat changes have to be carefully assessed considering both gestational stage and fetal activity during the examination. Starting from about 7 months of pregnancy the cardiac area is less frequently reached by this approach and so the external carotid pulse can be evaluated, this technique requires a lot of patience and experience since the fetal
movements make it hard to maintain the Doppler cursor focused on the carotid. The transrectal ultrasound examination performed at 9-10 months of pregnancy is the key to determine the fetal presentation, since during the last two month of gestation the fetus, due to his size, can only rotate along his longitudinal axis. The exam allows identifying if the fetus is in physiological cranial presentation or caudal or transverse presentation. The fetal orbit and the eye (Fig. 14) are normally used to recognize the head, but there are many others structure which can easily confirm the cranial fetal presentation: the skull, the guttural pouches and epiglottis, the trachea, the nostrils, the tongue and teeth, the nasal turbinates, and the ears. (Fig 15) At this stage of gestation the CTUP can increase until 12-13 mm and the appearance changes due to a varying degree of physiologic edema of the allantoic layer that makes the components readily differentiated. (Fig.16) In some cases a dramatic increasing of the CTUP has been detected at this stage of gestation (Fig 17) without any other symptoms and without effect on the newborn foal, and appear to be associated to an edema of the uterine component. The cervix, the fluids and the blood flow from the uterine artery can be monitored at this stage of pregnancy for any abnormal changing.

Results

Using a transrectal ultrasound approach, several conditions were detected between 4 and 9 months of gestation. Examining mares by transrectal ultrasound at 4 month of gestation, resulted in identification of cases of twins, a male with absence of gonads, an abnormal fetus with temporary ascites (Fig.18), a fetus with mega-bladder and ascites (Fig.19), a case of transient ascite resulting in a healthy foal, a fetus with umbilical torsion resulting in acute ascite and abortion (Fig. 1) and few cases of remaining of the yolk sac. We have also found fetuses with hyperechoic kidney (Fig.20) without effect on the newborn foals. The examination performed around 7 months of gestation allowed to diagnose transverse presentation, cases of placentitis, hydroallantois or hydroamnion, a fetus in posterior presentation associated with umbilical torsion and a fetus with monolateral congenital cataract (Fig.21). Transrectal ultrasound examination at 10 months of gestation resulted in identification of fetuses in posterior presentation, a body pregnancy, transverse presentation and premature placental detachment.

Discussion

Transrectal ultrasound examination of the mare from advanced gestation and up to term is an important tool that can help veterinarians to monitor the pregnancy through advanced gestation. In addition, this tool helps with identification of pathological conditions that can interfere with fetal well-being or delivery. Transrectal ultrasound examination of pregnancy in late gestation is an excellent adjunct tool to transabdominal ultrasound examination. These simple techniques can be very helpful to equine practitioners as valid diagnostic exams to be offered to clients in order to detect ongoing fetal diseases or to anticipate abnormal situations that would be otherwise detected only at birth. Moreover, most of these exams are usually performed out of season when equine practitioners are not as busy so that more time can be spent examining mares.

Presentation will be supplemented by videos.


2) Carrick J.B. Placentitis in horses: a major cause of late term foetal loss, 2010 RIRDC Australian Government Publication No 10/156


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**Fig 1. Fetal Ascite**

**Fig 2. Fetus 4 Months: Thorax**
Fig. 3. Fetus 4 Months: Cranial Abdomen

Fig. 4. Fetus 4 Months: Posterior Abdomen
Fig 5. Male Fetus

Fig 6. Female Fetus
**Fig. 7.** Color Doppler of the Umbilical Cord

**Fig. 8.** Yolk Sac Remnant
Fig. 9. Urachus Distension

Fig. 10. Combined Thickness Utero and Placenta
Fig. 11. Placental Detachment

Fig. 12. CTUP Folded Appearance
Fig. 13. Ectasia of the Allantoic Vessels

Fig. 14. Fetal Orbit
Fig. 15. Fetal Skull

Fig. 15a. Fetal Larynx and Guttural Pouch
Fig. 15b. Fetal Teeth

Fig. 15c. Fetal Features in Cranial Presentation
Fig. 16. Edema of the Allantoic Component

Fig. 17. CTUP: Edema of the Uterine Portion
Fig. 18. Fetal Ascite

Fig. 18. Fetal Mega-Bladder
Fig. 20. Hyperechogenic Kidneys

Fig. 21. Fetal Lens Cataract and Luxation