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Case Report

Electrocardiographic confirmation of a twin pregnancy in a mare at 8 months of gestation

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Abstract A 15-year-old Warmblood mare, at 8 months of gestation, was presented to the Ghent University Faculty of Veterinary Medicine for evaluation of suspected stage one labor. Transrectal ultrasonography revealed no clear signs of placentitis or stage one labor. The combined thickness of uterus and placenta was 11 mm and the cervix was closed. Twin pregnancy was suspected by transabdominal ultrasonography but could not be confirmed with certainty. An electrocardiogram (ECG) was recorded from the mare's abdominal wall to register a fetal ECG. To confirm twin pregnancy, registration of both fetal ECGs simultaneously on the same ECG trace was attempted. Twelve different electrode configurations were used. In 11 recordings, one fetal ECG was visible. Only one specific right-sided electrode configuration showed both fetal ECGs at the same time, which confirmed twin pregnancy. Although electrocardiographic diagnosis of a twin pregnancy in a mare is possible, this case highlights the need for multiple electrode configurations and the high likelihood of false negatives.

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A 15-year-old, pluriparous Warmblood mare, at 8 months of gestation, was admitted to the Ghent University Faculty of Veterinary Medicine for suspicion of premature stage one labor. At home, the mare appeared to be uncomfortable with signs of pawing, sweating, and lying down and standing up frequently. On physical examination, the mare seemed calm and comfortable and vital signs (heart rate, respiratory rate, and rectal temperature) were within normal ranges. An enlarged udder was noted. Most important differential diagnoses for early mammary development are placentitis or twin pregnancy. Transrectal ultrasonography was performed to evaluate the combined thickness of uterus and placenta, which represents the degree of attachment or separation of the placenta. In this case, the combined thickness of uterus and placenta was 11 mm, which is outside the reference range (<7 mm). Increased combined thickness of uterus and placenta is an important indication of placentitis but can also be a sign of placental compromise for instance in case of twin gestation [1]. Stage one labor could be excluded because the cervix was still closed (grade III on transrectal ultrasonography [2]). On transabdominal ultrasonography, a twin pregnancy was suspected as a fetus could be partially seen to the left side and the right side of the linea alba. Owing to the positioning of the colon and cecum in relation to the uterus, it was impossible to visualize both fetuses simultaneously. To confirm the suspected twin pregnancy, a telemetric electrocardiogram (ECG) device[c] was attached to the mare's abdominal wall. The ECG was digitized and displayed via Bluetooth connection on a portable computer. The 'fetus ECG mode' of the Televet 6.0 software was used with filter convergence attuned to slow and 50 Hz as described by Nagel et al. [3]. In this mode, lead I reveals the combined ECG of the mare and the fetus recorded between the red and yellow electrode. Lead II shows the ECG of the mare, recorded between the green and the red electrode. The third trace reveals the ECG of the fetus, which is obtained by subtracting the maternal deflections from the combined ECG of the mare and the fetus and amplifying the residual fetal deflections.

In total, ECGs were recorded with 12 different electrode positions (Table 1). In the first attempt to record a twin ECG (original position, ECG 1), electrodes were placed as described by Nagel et al. [3]: all electrodes were placed on the left side of the mare, the green electrode (left leg) was placed on the neck, the yellow electrode (left arm) on the middle of the flank region, the black (neutral) electrode on the gluteal muscle, and the red electrode (right arm) on the linea alba 15 cm cranial to the udder. In an attempt to record an ECG of both fetuses at the same time, the yellow or red electrode position was altered every 5 min. The yellow electrode was alternately placed 15 cm cranial and 15 cm caudal to the original position on the middle of the left flank. For each yellow electrode position, the red electrode was alternately placed 15 cm to the left of the original position on the linea alba. This resulted in six left-sided recordings (Fig. 1). Next, all electrodes were placed on the right side of the mare in a similar position. Again, the yellow electrode was placed on the mid-right flank, 15 cm more cranial and 15 cm more caudal at the same height, and for each yellow electrode position, the red electrode was placed 15 cm cranial to the udder on the linea alba and also 15 cm to the right of the linea alba. This resulted in six right-sided ECG recordings (Fig. 1). The mare tolerated the procedure well. The ECG files were saved for further offline analysis.

Offline analysis of the ECG files was performed at a paper speed of 50 mm/s. Mean fetal and maternal heart rates were calculated from 10 consecutive heart beats. The heart rate of the mare ranged from 49 to 61 bpm. Significant artifact was often present on the fetal ECG trace. In 11 of 12 recording positions, only one fetal ECG was clearly visible on the fetal trace (Fig. 4). Only at one specific electrode location (ECG 10, Fig. 2), the heart rate of both fetuses could be clearly visualized at the same time. Deflections of the fetal QRS complexes were separated based on QRS morphology [4] and identifying repetitive, regular R—R sequences, not by amplitude of the QRS complexes as the fetal QRS amplitude is known to be variable [5]. In addition, on several occasions, a QRS complex superimposed on another QRS-T could be identified, indicating that two separate rhythms were present (Fig. 3). On this twin recording, one fetus had a heart rate of 96 bpm, and the other had a rate of 118 bpm.

Upon follow-up transabdominal ultrasonography 2 days later, twin pregnancy could be confirmed by visualizing both fetal heart beats as well as the presence of a twin membrane.

Discussion

Although twin ovulations are common in the horse [6,7], twin pregnancy after 40 days of gestation is rare, since breeders and veterinarians aim to ensure that only one embryo reaches fetal state

[c] Televet 100, Engel Engineering Services GmbH, Heusenstamm, Germany.

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