Transabdominal Combined with Transrectal Ultrasonographic Determination of Equine Fetal Gender During Midgestation

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Transabdominal combined with transrectal ultrasonographic examination of pregnant mares is an accurate method to determine fetal gender during midgestation. Findings are based on the visualization of the prepuce or the penis in males and the mammary glands and their teats and the characteristic appearance of the ovaries in females. Authors’ addresses: Dept. of Veterinary Surgical and Radiological Sciences (Renaudin and Gillis) and California Regional Primate Center and Dept. of Pediatrics (Tarantal), University of California at Davis, Davis, CA 95616. © 1997 AAEP.

1. Introduction

Mare owners are increasingly interested in gender determination because the sex of the fetus can directly influence a sale. Some stallions are known to have a greater proportion of quality female versus male offspring (or the opposite). Therefore, we are beginning to see advertisements for stallions with studfees higher for one sex or the other.

Equine fetal sex determination is currently possible early in gestation by using a transrectal ultrasonographic approach. It is based on the identification and the location of the genital tubercle in proximity to the umbilical cord in the male and the tail in the female. However, this technique has two major drawbacks: (1) it requires considerable experience; and (2) it allows fetal sex determination only during a short window, with the optimal time being between days 59 and 68. After day 68, fetuses are deeply placed in the uterus and are not readily accessible for imaging. The advantage of the transabdominal versus the transrectal approach is that the entire fetus can be observed for a longer time period. Thus it is possible to increase the period of time for fetal sex determination.

The purposes of this study were as follows: first, to study whether transabdominal ultrasonography could be an alternative technique for determining equine fetal gender; second, to assess the predictive value of in utero gender identification by this method; and third, to determine the period of time for optimal identification of fetal gender by using a combination of transrectal and transabdominal ultrasonographic techniques after 100 days of gestation.

2. Materials and Methods

Mares: A total of ten pregnant mares (seven Quarter Horses and three Thoroughbreds) with known breeding and ovulation dates, stabled at the Center for Equine Health (Davis, CA), were used.

Ultrasonographic examination: Each mare was
scanned by a single experienced operator, twice monthly, starting at 100 days of gestation (day 0 = day of ovulation) until parturition. Transrectal and transabdominal ultrasound examinations were performed by using a SonoAce 1500* with real-time 5-MHz and 3.5-MHz linear transducers. For the best image quality to be obtained via the transabdominal approach, an ultrasonic coupling gel was applied to the abdomen of the mares after clipping the hair from the mammary glands to the xyphoid. The mares were confined in a stock without sedation. The ultrasonographic appearance of both the external genitalia (penis in the male and mammary glands in the female) and the gonads were studied. Each fetus was viewed in sequential cross-sectional, frontal, and sagittal planes. For orientation purposes, the fetal heart was initially located and then the transducer was moved caudally across the fetus to obtain sequential views. The area immediately caudal to the umbilical cord was carefully examined. Male gender was determined based on the presence of the prepuce or the penis immediately behind the umbilical cord. Female gender was determined based on the presence of the mammary glands and their two teats. Each fetal sex determination was performed without reference to the previous results. All ultrasonographic examinations were videotaped to allow later detailed studies and to store images.

At birth, foal gender was compared with fetal gender determined by ultrasonography.

3. Results
The ten mares gave birth to three fillies and seven colts. There was 100% agreement in gender identification between the results obtained by ultrasonography and those obtained at birth.

In males, the prepuce or the penis was consistently seen from 102 days to 219 days of pregnancy. There were two exceptions—one at 130 days and the other at 199 days. After 220 days of gestation, the external genitalia was not consistently identified. The last male fetus identification was made at 258 days. The prepuce on cross-sectional views had a round shape up to ±140 days and then appeared triangular (Fig. 1). It contained parallel echogenic lines. It was pendulous particularly after fetal movements. One fetus was observed with an erect penis at 194 days of gestation. The prepuce, the penis, and the urachus were clearly seen (Fig. 2). To our knowledge it is the first time that fetal male erection has been identified in the equine species. It occurs in human fetuses and is considered to be a normal behavior. The gonads were oval in shape and 2–7 cm in length, depending on the stage of gestation. They were situated in the caudal ventral abdomen along the thighs on frontal views. Their echogenicity was similar to that of the fetal liver. They appeared homogeneous with a thin longitudinal straight and central echoic line that was not consistently present after 125 days.

In the three females, the mammary glands with their two teats were seen consistently from 133 days to 227 days of pregnancy. The one exception occurred in one fetus at 148 days. After 227 days of gestation, the fetal ventral abdomen could not be readily visualized. The teats were not identified prior to 118 days and were inconsistently seen from
119 days to 133 days of gestation. They were best observed on a cross-sectional view (Fig. 3). They were hyperechoic, as was the triangular perineal raphe. The gonads were oval and were similar in size and location to the male gonads up to the time they could no longer be imaged. The overall echogenicity of the female gonads was similar to that of the fetal liver; there was an hyperechoic circle and center separated by homogeneous tissue consistently imaged through 133 days of gestation (Fig. 4). After that time, the entire circle, or half or a smaller part of it, is detected.

4. Discussion
One hundred days of gestation was chosen to start the study, because at this time the fetus can be imaged transabdominally. Using the combination of transrectal and transabdominal approaches, the entire fetus can be viewed. The transrectal examination is particularly useful when fetuses are in posterior presentation. This approach allows a good view of the fetal hindquarters and thus is helpful for gender identification. The 5-MHz probe is most often used transabdominally up to 150 days of gestation. For later stages of pregnancy, the 3.5-MHz probe is necessary. The transabdominal approach is very safe for the mare, which avoids a problem with owners who are reluctant to have their pregnant mares palpated. Transabdominal ultrasonography should also prove advantageous for small mares such as American Miniature horses and ponies, as well as for nervous mares.

Fetal sexing is possible based on the identification of the prepuce or penis or the mammary glands and their teats from 100 days to 240 days in males and from 118 days to 227 days in females, respectively. A triangular echogenic perineal raphe corresponding to the mammary glands can be observed before 118 days and after 227 days, but because it does not appear significantly different in male and female fetuses, it cannot be used to determine gender assignment. Before 118 days of pregnancy, the teats are probably too small to be seen and detailed examinations of the hindquarters are difficult because of the activity of the fetus. After 200 days of gestation, it is increasingly difficult to identify the external genitalia in both sexes because fetuses are too large to be readily imaged. They will typically lie on their backs and rotate only slightly at this stage of gestation; therefore, the ventral aspect of their bodies cannot be readily scanned. A 2.5-MHz probe with greater depth penetration may be helpful to perform sexing later in gestation. However, the acoustic shadow created by the growing femurs or tibias impairs the visualization of the ventral aspect of the caudal abdomen.

The difference in the ultrasonographic appearance of male and female gonads is best observed between 100 days and 135 days of pregnancy. We suggest that the circular echo noted in female gonads during this period of time could be used as a parameter to identify female fetuses prior to visualization of the teats. Thus, female fetuses could be identified after 100 days. The position of the gonads in both sexes is similar in the time period for this study. This would certainly change close to birth, with the entrance of the testis into the inguinal canal typically beginning between 270 days and 300 days of gestation.2

5. Conclusions
Equine fetal sexing can be accurately determined from 100 days to 220 days of gestation by using a
combination of transrectal and transabdominal ultrasonographic technique. The optimal time previously described by Curran\textsuperscript{1} is only 9 days from 59 to 68 days of pregnancy. In this study, we demonstrate that the time window can be increased by tenfold up to 100 days. Therefore, this technique allows rechecks to confirm a first presumption or midgestation diagnoses.

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References and Footnote


\textsuperscript{a}SonoAce 1500, Medison America, 5880 W. Las Positas Blvd. #52, Pleasanton, CA 94588.