Determination of Fetal Gender by Transrectal Ultrasound Examination: Field’s Experience

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Determining fetal gender by transrectal examination between 55 and 75 and 100 and 150 days of gestation can reach 100% accuracy in routine stud practice. Author’s address: Veterinari Associati Ippovet, Carpiano, Milan, Italy; e-mail: marco.livini@libero.it. © 2010 AAEP.

1. Introduction

Fetal determination has been conducted for almost 20 yr. In 1989, Curran and Ginther first identified fetal gender by evaluating the location of the genital tubercle in the male and female fetus using transrectal examination between 54 and 84 days of gestation. More recently, others have described fetal-gender determination in mid- and late pregnancy using a transabdominal technique. Knowing fetal gender has economic importance. Fetal gender is used to determine which mares are to be taken to sales and what stallions are booked the following season, because stud fees and sales revenues differ according to the foal’s gender. Male foals or yearlings frequently sell for more money than females. It is also possible to adjust insurance fees of pregnant mares according to fetal gender. The aim of the present work is to show that transrectal determination of fetal gender between 55 and 75 and 90 and 150 days of gestation can be accomplished in a timely manner in routine stud practice if the veterinarian is experienced in reproductive ultrasonography.

2. Materials and Methods

Five hundred seventy-two transrectal ultrasonographic examinations of the reproductive tract conducted between 2006 and 2008 to determine fetal gender were reviewed. Mares were of Standardbred (310), Quarter Horse (20), Warmblood (78), Arabian (26), or Haflinger (7) breeding and ranged in age from 3 to 18 yr. Examinations were performed during daily farm trips between 55 and 70 days and between 90 and 150 days of gestation. One hundred forty-one mares were examined two times at different stages of gestation. Duration of each examination was limited to 150 s. All scans were recorded with a digital video recorder and then classified and reviewed to identify time required for diagnosis, anatomical structures detected, and time needed for their localization. Correct sex determination was confirmed at birth. If the sex at birth differed from that diagnosed during fetal-gender determination, it was recorded as an error; if the fetal-gender examination exceeded 150 s, it was recorded as a negative result. Transrectal ultrasound exams were performed with multi-frequency linear probes working at 5–7.5 MHz. Mares were examined in stocks or adequately restrained, usually by lifting the
front leg; chemical sedation was not used. Sex determination between 55 and 75 days was based on the location of the genital tubercle in male versus female fetuses. In the male fetus (Fig. 1, A–C), the genital tubercle, precursor of the penis, is located just caudal to the umbilical insertion into the abdomen. In female fetus (Fig. 2, A and B), the genital tubercle, precursor of the clitoris, migrates caudal to the perineal region just under the tail. Different planes of scanning are used to identify the location of the genital tubercle. Sex determination between 90 and 150 days of gestation includes identification of a number of structures. The target organs to be detected in the female fetus are: teats and mammary gland (Fig. 3, A–C), vulva and clitoris (Fig. 4), and gonads (Fig. 5). Female gonads consist of cortical and medullary components divided by a thin concentrical line that are readily detectable in an ultrasound image. In the male fetus, the target organs are: penis and prepuce (Fig. 6), urethra (Fig. 7), epididymis (Fig. 8, A and B), testicular lodges (Fig 9), and gonads (Fig. 10). Male gonads are homogeneous in the ultrasonographic image and contain a slightly echogenic central line, likely reflecting the central vein.

At around 90 days of pregnancy, sexing the fetus transrectally seems to be difficult. At this stage, because of the increase of allantoid fluid, the pregnancy has pulled cranio-ventrally, passing the pelvic brim; the fetus, which is relatively small at this stage, cannot be reached with a transrectal approach. From 100 days of gestation onward, increased fetal size allows detection of all involved structures.
structures by transrectal ultrasonography. After 150 days of pregnancy, if the fetus is in cranial presentation, sexing is very difficult, because the caudal portion of the fetal body, where the target organs are located, cannot be reached for scanning. In that case, the transabdominal approach is the preferred method of diagnosis.

3. Results

Two hundred thirty-two sex determinations were conducted between 55 and 70 days of gestation. A correct diagnosis was made in 203 examinations, diagnosis was not made within 150 s in 24 cases (negative), and an incorrect diagnosis was made in 5 cases. Mean time to diagnose fetal sex decreased as experienced increased. Mean time to diagnose a female fetus was 67 s in 2005 and 43 s in 2008, whereas mean time to diagnose a male fetus was 60 s in 2005 and 30.5 s in 2008.

Three hundred forty-one sex determinations were performed between 90 and 150 days of gestation. A correct diagnosis was made in 299 scans, with one fetus misdiagnosed. Sex was not determined within 150 s in 41 fetuses. Slower exams (diagnosis not made in 150 s) were recorded in 2006/2007 and 2007/2008 because of the higher number of scans performed between 90 and 95 days of pregnancy, when the fetus is not readily accessible to ultrasound imaging.
When the sexed fetus was a male (n = 132), the first structures detected were the penis and prepuce (n = 96) and then the gonads (n = 36). Diagnosis of fetal sex was determined by identification of only the penis and prepuce in 70 cases and of only the gonads in 11 cases. All structures were detected in 51 cases.

When the sexed fetus was a female (n = 169), the gonads were the first structures detected in 119 cases, the mammary gland and teats were the first structures detected in 41 cases, and the vulva and clitoris were the first structures detected in 9 cases. Sex determination was based only on detection of fetal gonads in 20 cases, only on detection of the mammary gland and teats in 12 cases, and only on detection of the vulva and clitoris in 1 case. More than one structure was identified in 136 cases. Mean time to determine fetal sex decreased from approximately 83 s in 2005 and 2006 to 55 s in 2007 and 2008.

4. Discussion
Determination of fetal sex by transrectal ultrasonography between 55 and 75 days requires ultrasonographic experience, a quality ultrasound machine, proper lighting, time, and patience. Male fetuses were identified more quickly than female fetuses, because the genital tubercle can be observed in more scanning planes. However, more than 80% of all cases were identified within 150 s, and the time
to identify fetal sex decreased over the years of study as more experience was gained. Determination of fetal sex between 90 and 150 days of gestation offered more advantages than examinations conducted between 55 and 75 days of gestation. Advantages include increased fetal size and the opportunity to detect more than one organ to differentiate a male versus a female fetus. In addition, these exams are usually performed out of season when theriogenologists are not as busy, and therefore, more time can be spent examining mares. Of 132 fetuses identified as males between 90 and 150 days, the first organs detected in 96 cases were the penis and prepuce, whereas in the remaining 36 cases, the first organs detected were the gonads. The penis and prepuce are more easily identified by ultrasound examination than the thin echogenic line at the center of the gonad, which is a peculiarity of the male’s gonads.

Of 169 fetuses detected as females, the gonads were most commonly identified as the first organ (n = 119). The gonad of the female fetus is readily recognizable by a concentric echogenic line that divides the ovarian cortex from the medulla. The mammary glands and teats were detected as the first organs in significantly fewer cases (n = 41). Female fetuses were most commonly determined by identifying more than one structure (81%).

The best time to sex the older fetus is between 110 and 130 days of gestation, when the rate of positive diagnosis was close to 100%. During this period, the fetus is readily accessible, and fetal size enables one to scan the whole body; moreover, all the organs are easily recognized. At around 90 days of gestation, the fetus is not easily detected, and therefore, the rate of positive diagnosis is lower (48.8%). Positive diagnoses increased to 92.3% between 100 and 110 days of gestation and then decreased to 88% between 130 and 150 days of gestation. It is difficult to scan the caudal regions of the body where the target organs are located after 150 days of gestation if the fetus is in cranial presentation because of increased fetal size. There were no differences in the time to identify male or female fetuses between 90 and 150 days of gestation, and the time required to determine sex decreased with experience. It took longer to detect the vulva and clitoris in female fetuses, because these structures were identified in only a few scanning planes.

In conclusion, sex determination by the transrectal ultrasonographic approach was an effective technique both in the earlier gestational stage (55–70 days) and the later gestational stage (90–150 days). Time required to determine sex was less than 150 s in more than 85% of the cases, which allows this practice to be employed even at the peak of the breeding season. The best time for sex determination and issue of an official certificate is at 110–130 days of pregnancy, when the rate of positive diagnosis is 100%.

References and Footnotes


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