

Equine fetal gender determination from mid- to advanced-gestation by ultrasound

S. Bucca*

The Irish Equine Centre, Johnstown, Naas, Co. Kildare, Ireland

Abstract

Equine fetal gender can be easily determined by ultrasound between Days 120 and 210. A combination of transrectal and transabdominal ultrasound examinations can visualise fetal sex organs up to 8 months of gestation. Early equine fetal sexing techniques, performed between approximately Days 58 and 70, are aimed at identifying the position of the genital tubercle. A wider diagnostic window, a diagnosis based on several parameters, and the ease of identification of fully developed fetal primary sex organs make gender diagnosis in mid- to advanced-gestation a preferable technique. © 2005 Elsevier Inc. All rights reserved.

Keywords: Fetal gender; Fetus; Ultrasound; Mare; Pregnancy

1. Introduction

A wealth of information on equine fetal anatomy and physiology has been acquired in recent years. Ultrasound fetal monitoring techniques have documented in great detail, fetal growth and organ development at various stages of gestation. The echographic anatomy of fetal sex organs, from genital tubercle to fully developed organs, have been extensively described in their entire progression. Clinicians with substantial experience in ultrasound assessment of fetal well-being can easily familiarize themselves with gender determination techniques.

Fetal gender determination in the mare can provide a useful service to breeders. Knowing fetal gender in advance allows for commercial strategies to be implemented, as the value of stock at sales time is often determined by the gender of the fetus. It is well

* Tel.: +353 45 866 266; fax: +353 45 866 273.

E-mail address: stefbucca@hotmail.com.

established that some stallions have a greater proportion of quality female versus male offspring, or just the opposite. Furthermore, culling broodmares is easier when fetal gender is known.

Early fetal gender determination in the mare is conducted with transrectal ultrasound, between approximately Days 57 and 70. The technique involves the identification of the genital tubercle, precursor of the penis in the male and the clitoris in the female. Around Day 55, the genital tubercle appears as a hyperechoic equal sign (=), located between the fetal hindlimbs, approximately an equal distance between the tail and umbilical cord. As gestation progresses, the genital tubercle migrates towards the tail in the female fetus and towards the umbilical cord in the male. This technique requires considerable expertise and allows consistent fetal sex determination within a small diagnostic window (optimal time, Days 59 to 68).

After Day 70, the fetus tends to be placed deeply in the mare's uterus and becomes quite inaccessible for imaging by transrectal ultrasound. Percutaneous transabdominal imaging of the equine fetus is possible as early as Day 100. At that stage, the fetus can again be visualised within the mare's pelvis. Using a combination of transrectal and transabdominal exams, the entire fetus can be viewed by ultrasound up to 8 or 9 months of pregnancy and fetal gender can be determined, with an optimal diagnostic window of Days 120 to 210.

2. Advantages

Compared with the early technique, fetal gender determination in mid- to advanced-gestation offers a wider diagnostic window. Furthermore, the examination is carried out during summer and fall or early winter, at a more convenient time of the year for the busy equine reproduction clinician. In addition, diagnosis considers three or four different parameters and evaluates fully developed fetal organs. Finally, a simultaneous assessment of feto-placental well-being can be carried out at a critical stage of development.

3. Equipment

B-mode, real-time portable scanners, equipped with 5–7.5 MHz linear-array transducers are adequate for transrectal assessments. Linear, sector or convex 3.5–5 MHz transducers can be used transabdominally up to Day 260, depending on the size of the mare, the thickness of her ventral abdomen and the stage of gestation. Occasionally, a 2.5 MHz transducer should be employed.

4. Technique

Transrectal ultrasound fetal viewing requires standard rectal palpation skills as for routine ultrasound examination of the mare's reproductive tract. Thorough cleansing of the mare's abdomen is necessary for diagnostic percutaneous ultrasound evaluation. Mares are best examined in stocks, but usually do not require sedation. Clipping, shaving, alcohol

and/or coupling gel application can optimise transabdominal imaging. During the summer months, excellent imaging can be obtained by simply spraying alcohol over the unclipped hair of the ventral abdomen.

Orientation of the sonogram commonly considers left as caudal for the mare and right as cranial. The fetal heart and chest will be initially located, as they are easy structures to identify. Recognition of anatomical structures will determine cranial and caudal directions, within the fetus. Fetal head and neck indicate cranial, while the bean-shaped, echolucent image of the stomach is used as landmark for caudal orientation. Fetal presentation will then be established as anterior, posterior or transverse. Fetal position will be defined as dorso-sacral or dorso-pubic in anterior or posterior presentation. Dorso-caudal or ventro-caudal positions will be identified in transverse presentation, if the fetal spinal cord or ventral abdomen is facing the mare's tail, respectively. Fetal posture will vary according to activity; a great array of limb, neck and head flexions and extensions will be identified. Temporary obstruction of the view over the parts of diagnostic interest can be caused by fetal bone structures in motion, casting acoustic shadows over the caudal abdomen.

Gender determination is made by scanning the caudal fetal abdomen, hindquarters, and buttocks to identify primary sex organs. Once the fetal hindquarters are located and fetal orientation is determined, a frontal plane of scanning is obtained, by localizing the entire spinal cord. By moving in a ventral direction, parallel to the fetal spine, the gonads are visualised within the fetal caudal abdomen. Gonads are carefully examined to evaluate their structure. Further ventral scanning will encounter the scrotal lodges and penile shaft in the male fetus and the mammary gland in the female. Cross-sectional views of this area will further identify these structures in detail. Cross-sectional scans directed towards the fetal tail will identify the urethra (male) or clitoris and vulva (female).

5. Fetal features

Fetal gonads are easily identified in the caudal abdomen, in proximity to the kidney and represent a good landmark of diagnostic value. A distinction between cortex and medulla can be made in the female fetal gonad. Male gonads appear uniformly echodense, with a small peripheral dotted area sometimes visible.

Male fetal features include: penis and prepuce, scrotum/testicular lodges, urethra, and gonad. The penis is visualised in the ventro-caudal abdomen, just caudal to the root of the umbilical cord. Sometimes the cord strong pulsatile activity impresses motion to the penile shaft, resting over it. The penis is partially or completely encased within the prepuce, but can often appear fully extended and occasionally erect. In the erect penis, the urethra is visualised in cross section as a distinct circular structure with a hyperechoic wall. The urethra can easily be visualised along the ventral shaft of the flaccid or erect penis as a double echodense line. Longitudinal and cross-sectional images of the urethra can be obtained on the male perineum. The fetal scrotum displays a composite echodensity, as the scrotal lodges appear as two symmetrical, oval, less echodense areas. Male fetal gonads appear uniformly echodense.

Female fetal features include mammary gland, nipples, vulva/clitoris, and gonad. Fetal mammary glands can be visualised in the pubic area and appear triangular or trapezoidal in

shape and uniformly echodense. Nipples emerge from the ventral border of the mammary gland as two large hyperechodense dots. No relevant structures can be visualised on the ventral perineum as opposed to the male fetus, where the urethra runs the entire length (up to the anus). The fetal clitoris is a hyperechoic structure that bulges out of the buttocks. It is positioned high up in the perineum and should not be confused with the anus, adjacent to the root of the tail. The vulvar commissure can be seen coursing between the anus and the clitoris, in a cross-oblique section.

6. Diagnosis

Diagnosis by a single transrectal exam is rapidly attained when the fetus is in posterior presentation, even up to 8 months of gestation. A transverse presentation allows easy gender determination with a transrectal approach when the fetus assumes a ventro-caudal position within the mare's pelvis. In anterior presentation, the fetal hindquarters can be visualised transrectally up to 5 months of gestation, according to fetal size and location within the uterus. Rotation of the fetus over the long and short axis is commonly observed up to 8 months of gestation. Fetal presentation changes more frequently in the early stages of gestation, up to 7 months. After 9 months, the fetal hindlimbs become engaged within the pregnant horn and fetal presentation does not change anymore under normal circumstances. A transabdominal approach is usually necessary for gender determination over 5 months of gestation for fetuses in anterior presentation. Good knowledge of fetal anatomy and rapid identification of fetal parts are essential for ease of diagnosis. Both cross-sectional and sagittal views are required for diagnosis. The time required to conduct a diagnostic examination is 2–15 min for the experienced examiner. Variability depends on the difficulty encountered in visualizing the areas of diagnostic interest. Very active fetuses make poor candidates for rapid diagnosis, as fetal hind limbs can often interfere with proper imaging. Videotaping of scans provides opportunities for further detailed studies.

In conclusion, fetal gender determination in mid- to advanced-gestation is an effective diagnostic tool. The wide diagnostic window makes this technique very appealing to busy clinicians. A quick assessment of feto-placental well-being can be concurrently conducted; this should prove beneficial, as a mid-gestation routine check of fetal environment and growth.