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Theriogenology Question of the Month

History

A 6-year-old multiparous Standardbred mare was examined at our veterinary medical teaching hospital because of dystocia of 4 hours' duration. The mare was considered to have a prolonged gestation (356 days of gestation at the time of parturition). Early in gestation (day 114), Potomac horse fever had been diagnosed, and the mare had been successfully treated. Otherwise, the pregnancy had been without any notable abnormalities until the time of admission. Attempts to mutate the postural defects and deliver the fetus at the farm were unsuccessful, and the mare was administered flunixin meglumine (1.1 mg/kg [0.5 mg/lb], IV) before transport to our facility.

Initial examination at the veterinary medical teaching hospital revealed that the mare was quiet and alert

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with a heart rate of 40 beats/min and respiratory rate of 20 breaths/min. Her mucous membranes were bright pink with a capillary refill time of 2 seconds. Abdominal auscultation revealed decreased intestinal sounds in all 4 quadrants. A catheter was inserted into a jugular vein, and the mare was sedated by administration of 200 mg of xylazine hydrochloride. Hair over the lumbosacral joint was clipped and the region aseptically prepared, and morphine was given via epidural administration.

Obstetric examination revealed that the fetus was engaged in the birth canal, with all 4 limbs and the nose extending caudally through the dilated cervix into the cranial aspect of the vagina; however, no fetal structures protruded through the vulva. Lack of Ferguson's reflex during the obstetric examination was most likely a result of uterine exhaustion attributable to the amount of time from the onset of labor. The fetus appeared to be in right cephaloiliac presentation. The fetus was unresponsive to stimulation, and it was presumed to be nonviable.

Question

What are 3 causes of dystocia in which there are 4 fetal feet in the birth canal? *Please turn the page.*

Answer

A fetus with transverse ventral presentation, multiple fetuses (eg, twins) simultaneously entering the birth canal, or a fetus with a congenital deformity (such as schistosomus reflexus) are 3 causes of dystocia in which 4 fetal feet may be found in the birth canal.

Results

The mare was administered 5 L of lactated Ringer's solution IV, and administration of potassium penicillin (22,000 U/kg [10,000 U/lb], IV, q 6 h), gentamicin (6.6 mg/kg [3 mg/lb], IV, q 24 h), and flunixin meglumine (1.1 mg/kg, IV, q 12 h) was initiated. Anesthesia was induced by administration of ketamine hydrochloride (2.9 mg/kg [1.3 mg/lb], IV) and diazepam (0.14 mg/kg [0.065 mg/lb], IV) and maintained by administration of isoflurane in oxygen.

The mare was positioned in dorsal recumbency with the pelvic limbs elevated to facilitate manipulation of the fetus. Controlled delivery per vaginam was attempted. The uterus was expanded with a small amount of polyethylene polymer-based obstetric lubricant^a mixed in water. Attempts to repulse the hind limbs of the fetus and mutate the presentation and position of the fetus to achieve delivery per vaginam were unsuccessful. The mare was moved into a surgical suite and prepared for cesarean section.

A 35-cm incision was made on the ventral midline cranial to the umbilicus; the peritoneum was incised and the uterus identified. Contraction of the uterus around the fetus and the position and posture of the fetus made it difficult to completely exteriorize the uterus. The uterus and chorioallantois were incised in the region of the fetal tarsus. The pelvic limbs of the fetus were used to successfully extract the nonviable fetus from the uterus. At that time, it was evident that the fetus had severe scoliosis and that at least some viscera were located outside its body wall.

Hemostasis of the uterus was accomplished by placing a suture of No. 2 polyglactin 910^b in a simple continuous pattern along the incised margins of the uterus. The uterus was closed by use of No. 2 polyglactin 910 suture in a double-inverting pattern (ie, Utrecht-Lembert). Further exploration of the abdominal cavity revealed a 180° torsion of the large colon and volvulus of the cecum, which were corrected. The abdominal cavity was lavaged with sterile saline (0.9% NaCl) solution and then closed in a routine manner.

After surgery, the fetal membranes were retained. Oxytocin (20 U, IM, q 2 h) was initiated beginning 4 hours after surgery and continuing until the fetal membranes were passed 22 hours after surgery. Additional postoperative treatment included continuation of the antimicrobials and administration of flunixin meglumine (as needed). The forefeet and hind feet of the mare were packed in ice until the fetal membranes were passed.

Evaluation of the extracted 40-kg (88-lb) fetus revealed a condition similar to schistosomus reflexus (Figure 1). The fetus had pronounced scoliosis of the vertebral column to the right (Figure 2). The bones

were ankylosed in this posture, which positioned the pelvic limbs over the thorax and brachium. This accounted for the situation that resulted in all 4 feet of the fetus in the birth canal. Both the maxilla and mandible were markedly skewed (ie, wry nose) and deviated to the right. The fetus also had a substantial (20 cm in length) defect on the midline of the abdominal wall, which included the umbilicus and resulted in eventration. The diaphragm was intact, and the lungs were considered to be normal. The liver was firm and fibrotic; it weighed 1.5 kg (3.3 lb). Histologic examination of hepatic tissues confirmed the character of the gross hepatic abnormalities.

The fetus was a male and had a normal descended right testis and a hypoplastic left testis, which was retained in the abdomen proximal to the inguinal ring. The cerebrum had noticeable cavitations



Figure 1—Photograph of an equine fetus immediately after delivery by cesarean section.



Figure 2—Approximate dorsoventral radiographic view of the equine fetus of Figure 1. Soft tissues have been removed to enable a better view of the thoracic portion of the vertebral column, which has pronounced scoliosis to the right. Structures indicated are the cervical vertebrae (A), coccygeal vertebrae (B), and pelvic region (C).

(porencephaly), with considerable bilateral loss of both gray and white matter and dilated lateral ventricles (hydrocephalus).

Discussion

Schistosomus reflexus is a rare type of fetal monstrosity that is primarily reported in cattle.¹ The defining features in ruminants include inversion of the vertebral column, eventration of the abdominal viscera because of a fissure in the ventral abdominal wall, ankylosis of the limbs, positioning of the limbs adjacent to the skull, and hypoplasia of the lungs and diaphragm.¹ Although the equine fetus reported here did not have all of the classically described features, it did have severe scoliosis and a defect in the ventral abdominal wall with eventration. Other developmental anomalies in the foal included 1 atrophied and cryptorchid testis, porencephaly, and hydrocephalus. The relevance of the hepatic lesions is unknown.

Fetal monsters are rare in horses. The incidence is between 0.36% and 3.5%.² The first reported case of a schistosomus reflexus-like anomaly was of a fetus aborted at 150 days of gestation.³ Since then, similar anomalies have been reported in 2 full-term horse fetuses^{4,5} and 1 donkey fetus.² In those 3 fetuses and the fetus described here, a defect in the ventral abdominal wall with eventration and a major vertebral deformity were evident. The fetus described here had a lateral deviation of the vertebral column at the thoracolumbar junction, which was similar to that for 2 of the other fetuses (1 fetus had a deformity at the cervicothoracic junction, but the character of the vertebral malformation in the other fetus was not specified).

The exact mechanism that results in schistosomus reflexus is unknown. Syndromes similar to schistosomus reflexus appear in other species, including humans, and are believed to have a genetic cause.⁶ In humans, thoracoabdominal syndrome is postulated to be a sex-linked, dominant disorder.⁶ In cattle, schistosomus reflexus is hypothesized to be an inherited (autosomal recessive) condition.¹

Several hypotheses exist for the mechanism of schistosomus reflexus; however, application of these hypotheses to equids is speculative. These include genetic inheritance and maternal exposure to teratogens early during gestation.^{1,6} Genetic inheritance in the fetus described here was a possibility; however, this mare had previously given birth to a clinically normal foal sired by the same stallion. Teratogenic exposure early in gestation was also a possibility because an initial diagnosis of infection with *Neorickettsia risticii* (the agent that causes Potomac horse fever) was made at 114 days of gestation in the mare described here. *Neorickettsia risticii* can cause abortion in equids but has not been linked to congenital deformities.⁷ It is unknown whether the organism or any of the treatments instituted for Potomac horse fever (in this mare, oxytetracycline and dipyrone) had a teratogenic effect that could have led to schistosomus reflexus.

Alternatively, hyperthermia can cause teratogenesis in other species. The mare described here was acutely hyperthermic during the *N risticii* infection. However, infection with *N risticii* and hyperthermia as a cause of teratogenesis are unlikely for this fetus because organogenesis should have been completed by approximately 50 days of gestation.

It should be mentioned that the use of the polyethylene polymer-based obstetric lubricant is contraindicated in surgical candidates because peritoneal contamination can be fatal.⁸ The owner initially refused the option of cesarean section. However, after subsequent manipulative efforts were unsuccessful, the owner requested that we perform a cesarean section despite the risks from our preceding use of the obstetric lubricant.

Schistosomus reflexus and similar anomalies are rare congenital deformities reported in multiple species. The mechanism and overall importance of these deformities in equine reproduction are unknown. Schistosomus reflexus-like abnormalities should be considered when dystocia is determined to be attributable to a fetus with all 4 fetal limbs in the birth canal. Cesarean section is one of the safest means to extract such an abnormal fetus when adequate surgical facilities are available. However, fetotomy can also be performed safely and efficiently and is another option.

Outcome

This mare belonged to a well-managed Standardbred farm. Schistosomus reflexus or other similar fetal anomalies have not been detected in offspring from this mare or the stallion used for the mating that resulted in the fetus described here. The mare recovered well from the cesarean section, was bred again, and was examined and found to be pregnant.

- a. J-Lube, Jorgensen Laboratories, Loveland, Colo.
- b. Vicryl, Ethicon, Somerville, NJ.

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