The administration of ketamine combined with diazepam for induction of anesthesia in mares presenting for dystocia results in detectable levels of diazepam in foals at birth. Detectable levels of diazepam did not seem to influence the outcome of these cases. Authors' address: Rood and Riddle Equine Hospital, PO Box 12070, Lexington, KY 40580; e-mail: lbidwell@roodandriddle.com. © 2008 AAEP.

1. Introduction
One of the most commonly used anesthetic-induction protocols for equine patients is the combination of ketamine and diazepam. This combination produces a fast and safe means of recumbency in horses for emergency or elective procedures. There is concern when using this induction method with pregnant mares, because it is believed that diazepam builds up in the fetal compartment. Human studies have shown rapid distribution of diazepam in the fetus from maternal blood and significantly elevated levels of diazepam in umbilical cord serum over maternal serum immediately after birth when diazepam was used as a pre-anesthetic. Mean desmethyl-diazepam levels (a metabolite) were not significantly different. Therefore, many small animal and equine veterinary practices will avoid this combination for dystocia or cesarean delivery because of the fear that the induction agent will produce respiratory depression in the fetus at birth. To the authors’ knowledge, there are no published reports of diazepam levels in foals after induction of anesthesia with the combination of ketamine and diazepam in pregnant mares. Therefore, the purpose of this study was to determine if diazepam levels were present in foals at birth compared with mares.

2. Materials and Methods
This study was carried out at Rood and Riddle Equine Hospital in Lexington, Kentucky, which is an equine referral practice that received 54 dystocia cases in 2007. On presentation for dystocia, mares were administered xylazine at 1 mg/kg, IV for sedation, and a 14-g Mila catheter was placed aseptically in the right jugular vein. This was followed by administration of ketamine at 2.2 mg/kg, IV combined with diazepam at 0.8 mg/kg, IV for induction of anesthesia. The mares were then intubated; isoflurane anesthetic was administered with intermittent positive pressure ventilation, and the surgeon attempted controlled vaginal delivery of the foal. Triple-drip anesthetic was initially administered intravenously (50 g guaifenesin, 500 mg xylazine, and 1 gm ketamine) as a bolus for relaxation. A maximum of 20 min was allotted for attempts at controlled vaginal delivery until the surgeon determined if the mare must be moved to the surgical suite for cesarean section. After delivery of the foal and initial stabilization, venous blood was drawn...
from the foal and mare in red-topped glass vials and spun down; the serum was separated, placed in glass tubes, and frozen until testing. The time of blood collection was synchronized between the mare and foal at 5–7 min post-foaling. Blood samples were sent to Cornell University for testing by capillary glass chromatography/mass spectrometry with a sensitivity of 0.5–1 parts/billion. Foal activity and care were evaluated through discharge, death, or euthanasia. This study was approved by an Animal Use and Care Committee.

3. Results

Fifteen randomly selected mare/foal pairs were included in the study. Of these cases, two of the foals were delivered by cesarean section. The remaining 13 foals were delivered by controlled vaginal delivery. The average anesthetic time for controlled vaginal delivery was 13.85 min, and the average anesthetic time for cesarean section at the point that the foal was delivered was 27.5 min. Blood was drawn from the mares and foals by 20 min post-induction of anesthesia in the controlled vaginal delivery cases and within 37 min of induction in the cesarean section cases. The mean diazepam concentration in mares was 96.81 ng/ml with an SD of 40.16 ng/ml, and the foal mean diazepam concentration was 55.54 ng/ml with an SD of 15.08 ng/ml. Detectable levels of diazepam were present in all of the mares and foals. Of the 15 mare/foal combinations, 13 of the foals survived to discharge. The two cases that did not survive were a foal that was euthanized because of uncorrectable limb deformities and a foal that died from hemorrhage associated with rib fractures. Five of the 15 cases were spontaneously breathing at birth (12–48 breaths/min) and did not require assisted ventilation, eight cases had spontaneous but weak ventilation (6–12 breaths/min) that required assistance, and two cases required manual ventilation until active spontaneous ventilation was apparent (within 30–45 min). The average hospital stay of the surviving foals was 5.3 days. Two of the surviving foals had signs associated with neonatal hypoxia. One of those foals developed pathology associated with sepsis that required surgical correction of an infected umbilical stump and joint lavage for a septic hock.

4. Discussion

The goal in management of dystocia birth is a healthy mare and foal. Induction of anesthesia for controlled vaginal delivery or cesarean section should be quick, safe, and effective. The combination of ketamine and diazepam for induction has been used for many procedures in horses, but until now, no studies have researched this combination for dystocia anesthesia. The current study found detectable levels of diazepam in mares and foals after dystocia birth, and average foal levels were 50% of the mare values. Although it is difficult to determine whether diazepam levels were associated with ventilatory depression, the diazepam levels in neonates did not seem to negatively affect the outcome of these cases.

References