Retained fetal membranes in an African elephant (*Loxodanta africana*)

Jack Kottwitz,[a] Carolina Lopes da Cruz Torres Alpino,[a] John F. Roberts,[b] Amelia S. Munsterman[c]
[a]Veterinary Department, The Montgomery Zoo, Montgomery, AL; [b]Thompson, Bishop, Sparks State Veterinary Medical Diagnostic Laboratory, Auburn, AL; [c]Department of Clinical Sciences, College of Veterinary Medicine, Auburn University, Auburn, AL[*]

Summary

A 30 year old, nulliparous female African elephant gave birth to a stillborn, full term male calf. The cow had developed an elevated white blood cell count five weeks prior to parturition, however labor and parturition were without complications for the cow. The calf was stillborn with thoracic limb arthrogryposis, renal agenesis, and evidence of fetal stress prior to parturition. Fetal membranes were observed protruding from the vulva within 24 hours of birth, but that tissue did not pass spontaneously. Gentle manual extraction six days after parturition removed the protruding material which was determined to be amnion and a portion of the umbilical cord. The cow developed severe ventral abdominal edema and a significant leukocytosis, but remained afebrile with a normal appetite. Signs of labor were noted 86 days after the stillbirth, with the remaining chorioallantois and portion of the umbilical cord being passed spontaneously overnight. Ninety days postpartum, a large mucoid mass was passed. At that point the cow's ventral edema resolved completely, the white blood cell count returned to within normal limits. Hematology values remained within normal limits over the subsequent six months.

Keywords: African elephant, dystocia, *Loxodanta africana,* retained fetal membranes, stillbirth

Case presentation

A 30 year old female African elephant (*Loxodanta africana*) gave birth to a full term (> 610 days of gestation), stillborn, 120.5 kg male calf after showing intermittent signs of labor for 24 hr. An elevated white blood cell count (16.7 x 10^3 cells/µl; reference range 10.32 ± 2.837 x 10^3 cells/µl[1]) with neutrophilia (10.6 x 10^3 cells/µl; reference range 3.455 ± 1.737 x 10^3 cells/µl) was first noted 41 days prior to parturition. The cow demonstrated no observable signs of illness and maintained a normal appetite and attitude until parturition.

The cow had an apparently normal parturition 36 hours after serum progesterone levels returned to baseline, with the hardest labor lasting approximately 2.5 hours prior to the delivery of the stillborn calf. The calf had arthrogryposis of the thoracic limbs with both carpi fixed at 90 degrees flexion (Figure 1). Both eyes had pronounced hemorrhagic conjunctiva (Figure 2). Additional signs of fetal stress including petechial hemorrhage on the endocardial and epicardial surfaces were noted during gross necropsy (Figure 3). A significant portion of the lungs sank when placed in formalin confirming failure to initiate normal respiration. The primary bronchi contained green mucoid material consistent with aspirated meconium. The stomach also contained similar thick mucoid green material. The cecum was hyperemic with the colon distended with soft green meconium. There was no right kidney.

Fetal membranes protruded from the cow's vulva within 24 hours of birth, but that material did not pass spontaneously. Based on physical appearance of the protruding tissue, it was initially thought that the bulk of the fetal membranes were in the vaginal vestibule. The temperament of the cow did not permit extensive palpation of the perineal region or an attempt at ultrasonographic examination of the reproductive tract. A wet towel was tied to the protruding fetal membranes to attempt to utilize gravity to assist in the evacuation of retained tissues. An incomplete portion of the fetal membranes composed of amnion and a portion of the umbilical cord was passed six days later. No chorioallantois was present.

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[*] Present addresses: Department of Anatomy, Physiology and Pharmacology, College of Veterinary Medicine, Auburn University, Auburn, AL (Kottwitz); College of Veterinary Medicine, Centro Universitario Serra dos Orgaos, Teresopolis, Rio de Janerio, Brazil (Alpino); The Center for Animal Care Sciences, Smithsonian Conservation Biology Institute, National Zoological Park, Washington, DC (Roberts).

Histopathologic examination of the umbilical cord revealed numerous hairs incorporated into the outer tunic, suggesting the umbilical cord was compressed tightly against the fetus during parturition.

The cow's attitude and appetite remained normal after parturition, but she developed ventral abdominal edema approximately 36 hours after parturition that increased over the next two weeks. A hemogram performed the day after parturition revealed a mild leukocytosis (14.6 x 10^3 cells/µl) with moderate numbers of degenerate neutrophils. Vulvar discharge consisting of large drops of thick, dark red, mucoid material was noted after the allantois was passed. Ciprofloxacin (Pack Pharmaceuticals, LLC, Buffalo Grove, IL; 2.5 mg/kg po twice per day for two weeks) was initiated. Direct bacterial culture of the vaginal canal or vaginal vestibule was not possible due to lack of cooperation by the cow. Culture of the vulvar discharge revealed heavy growth of *E. coli* and beta-hemolytic *Streptococcus*. Both bacteria were susceptible to ciprofloxacin. Repeat complete blood counts (CBC) at nine and 16 days after parturition showed little change in the white blood cell (WBC) count, although degenerate neutrophils were no longer observed. A CBC performed 25 days postpartum revealed significant leukocytosis (25.8 x 10^3 cells/µl), neutrophilia (19.3 x 10^3 cells/µl) and a left shift.

The WBC count remained elevated through the next month, yet the cow continued to have normal attitude, appetite and activity levels with an intermittent vulvar discharge. A repeated culture of the discharge showed light growth of beta-hemolytic *Streptococcus* with no *E. coli* growth. Based on the continued elevated WBC count and little apparent response to ciprofloxacin, the decision was made to change antibiotics. Oral ampicillin (DAVA Pharmaceuticals, Fort Lee, NJ; 8 mg/kg po twice per day) was chosen based on cost of treatment and antibiotic susceptibility. Two days after discontinuing the ciprofloxacin and starting oral ampicillin the cow became anorexic. Because of concern about possible gastrointestinal effects from the oral ampicillin, the antibiotic was not administered on the third day. That evening there was a significantly increased volume of thick, red, mucoid material from the vulva.

Fetal membranes were passed overnight, 86 days after parturition (Figure 4). Blood drawn that morning revealed continued leukocytosis (23.5 x 10^3 cells/µl) with neutrophilia (17.6 x 10^3 cells/µl). Ampicillin was continued. The cow's appetite continued to be decreased for the next four days, at which time a large amount of dark reddish, mucoid material was passed. After that material passed, the cow's appetite and activity level quickly returned to normal over the next 24 hours. The remaining ventral abdominal edema resolved over the next week. The CBC performed 93 days after parturition revealed decreased but still elevated WBC count (18.4 x 10^3 cells/µl). Hematology performed the next week revealed a normal WBC count (13.0 x 10^3 cells/µl). Ampicillin was continued for an additional two weeks, then discontinued as the WBC count remained within normal limits. The leukogram remained within normal limits and there was no additional vulvar discharge or other abnormalities noted in biweekly examinations for the next six months.

Discussion

There are few reports of retained fetal membranes in elephants, with this case representing the first report in an African elephant. Expulsion of the fetal membranes in elephants usually occurs within ten hours of birth.[2] Retained fetal membranes in domestic animals can be defined as membranes that have not passed within 24 hours of parturition.[3] Risk factors associated with retained fetal membranes in domestic cattle and horses include twins, dystocia, fetal death, stillbirth, induced parturition, abortion, milk fever and geriatric dams.[3,4] Dystocia and stillbirth are considered common in captive Asian and African elephants in North America.[5] Age of the mother may play a significant role in the incidence of dystocia and stillbirth. Pregnancies in captive nulliparous African cows over the age of 24 years have only resulted in dystocia or stillbirth in North America.[5,6] In addition, there has been only a small number of calves born to multiparous cows over the age of 24 years.[5] Age of the cow must be considered in this case of retained fetal membranes and stillbirth

There has been one confirmed case of arthrogryposis of an African elephant calf which caused angular limb deformity that was considered to be the likely cause of dystocia.[7] Etiologies of arthrogryposis in domestic species include genetic predisposition, exposure to Akbane virus or bluetongue virus (BTV) or ingestion the teratogens anagyrine or piperidine found in plants in the

Fabaceae family which includes lupine.[7] The cow had no known exposure to toxic plants known to cause arthrogryposis.

Bluetongue virus exposure is a possibility, as the virus is considered endemic in the Southeastern United States.[8] However, BTV was not confirmed in this case. *Salmonella* spp. has also been implicated as a potential cause of abortion and stillbirth in African elephants.[9] In this case, the cow showed no clinical signs of salmonellosis and cultures performed during necropsy of the calf, the maternal feces, and the fetal membranes proved to be negative for this etiological agent. Both the dam and the calf were also negative for elephant endotheliotropic herpesviruses.

First calving, maternal age, and arthrogryposis most likely contributed to difficult passage of the fetus and stress during parturition ultimately resulted in fetal death. The elevation in the WBC count six weeks prior to parturition is suggestive of placentitis of unknown etiology. Retention of the fetal membranes prevented complete and thorough examination of fresh tissues to determine possible etiologies.

Retention of the fetal membranes can have a wide variety of effects on the dam in domestic animals, ranging from fatal laminitis and death in domestic horses to spontaneous passage of the retained tissue and return to normal breeding soundness in domestic cattle.[3,4,10] Fetal retention has occurred in African elephants for time periods ranging from three months to over seven years without death of the mother, suggesting a unique ability of elephants to sequester the uterus and prevent systemic infection.[2,6,11,12] The elevated WBC count of the cow with the subsequent decline after membrane expulsion indicates an immune response that continued as long as the fetal membranes were retained.

This cow had a history of irregular estrous cycles for the three years prior to becoming pregnant with absent or incomplete records before that time. The estrous cycle during which conception occurred was the only normal cycle for which records were available. A large, polypoid urogenital mass was also passed prior to this normal cycle. A complete reproductive tract evaluation, including transrectal ultrasonography, performed four years prior to this birth indicated no apparent abnormalities at that time. It was not possible to fully evaluate the reproductive tract for the presence of other abnormalities or masses after that evaluation was performed. The cow's irregular reproductive cycle history and passage of the urogenital mass caused concern for the presence of unidentified uterine abnormalities. The potential for unknown uterine abnormalities combined with the apparent ability of elephants to retain fetal tissues without subsequent maternal death and uterine ruptures associated with the administration of oxytocin in elephants precluded attempts to administer ecbolic drugs.

The duration of retained fetal membranes increases the likelihood of significant fibrosis within this cow's uterus. Direct evaluation of the endometrium by means of a biopsy is not possible due to the anatomy and size of an African elephant. Therefore while it is unlikely that the uterus is capable of supporting another pregnancy, maternal age and the potential for a negative outcome suggests that future breeding is ill-advised.

Learning points

- African elephants appear capable of retaining fetal membranes for several months without outward detrimental effects.

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Figure 1: Stillborn, full term, 120.5 kg male African elephant calf born to 30 year old primiparous cow. Note the thoracic limb arthrogryposis with the legs fixed at 90 degrees flexion at the carpi and severe hyperemia of the right eye, suggestive of fetal stress during parturition. The etiological agent that caused the arthrogryposis may have also contributed to the retained fetal membranes of this case report.

Figure 2: Close-up of the eye of stillborn, full term 120.5 kg male African elephant calf showing significant hemorrhage of the conjunctival tissues, thought to be indicative of fetal stress during parturition.

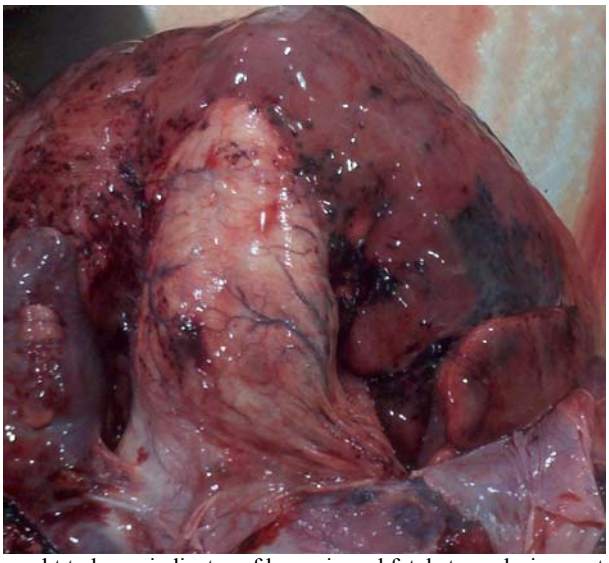

Figure 3: Cardiac petechiation, thought to be an indicator of hypoxia and fetal stress during parturition. The cause of fetal stress likely contributed to retention of the fetal membranes.

Figure 4: Choriollantois and retained umbilical cord fragment delivered 86 days after parturition from a 30 year old African elephant cow. Unfortunately due to the prolonged retention time of the fetal membranes, autolysis prevented complete diagnostic evaluation.

(Editor's Note: The photographs in this paper appear in color in the online version of *Clinical Theriogenology*.)