# Surgical and nonsurgical correction of uterine torsion in New World camelids: 20 cases (1990–1996)

Christopher K. Cebra, VMD, MS; Margaret L. Cebra, VMD, MS; Franklyn B. Garry, DVM, MS; LaRue W. Johnson, DVM, PhD

**Objective**—To report clinical findings for New World camelids with uterine torsion and to compare results of 3 methods of correction.

**Design**—Retrospective case series.

**Animals**—11 llamas and 3 alpacas with 20 uterine torsions.

**Procedure**—Information concerning history, clinical signs, management, and postpartum complications was retrieved from medical records. Information concerning subsequent reproductive performance was obtained by telephone interview of owners.

**Results**—Uterine torsion was corrected by celiotomy (n = 7), transvaginal manipulation (5), or rolling the dam (8). Direction of 19 of 20 torsions was clockwise when viewed from the rear. Retention of fetal membranes was reported for 5 camelids that underwent celiotomy, but was not reported in camelids after nonsurgical correction. The uterus prolapsed in 1 llama that underwent celiotomy and in another that underwent the rolling technique. Although 2 camelids that underwent celiotomy subsequently failed to conceive, all camelids treated by nonsurgical techniques conceived.

**Clinical Implications**—Uterine torsion in camelids may be diagnosed by methods similar to those used in cattle. Surgical and nonsurgical methods can be used to correct torsion, and postpartum complications are rare when torsion is corrected by a nonsurgical method. (*J Am Vet Med Assoc* 1997;211:600–602)

Uterine torsion has been described as a cause of colic or dystocia in many large animal species,[1-5] including Old World[6-8] and New World[9] camelids. For many large animals, celiotomy is the preferred method of correction of uterine torsion, because the uterus can be examined and manipulated carefully through the incision, and cesarean section can be performed.[1-9] Transcervical manual correction of uterine torsion also has been described,[2-4] but this technique may not be adequate to correct severe torsion or torsion cranial to the cervix. Rolling the dam in the direction of the torsion while applying external pressure on the abdomen also has been used to correct uterine torsion, especially in cattle[3,4] and horses.[2] Nonsurgical techniques of correction are advantageous, because they do not require general anesthesia and celiotomy, are inexpensive, and can be performed on site but also are disadvantageous, because they do not enable viewing of the uterus and require subsequent vaginal delivery of the fetus.

From the Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523. Drs. Cebra's present address is Department of Health Management, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, PEI, Canada C1A 4P3.

Surgical correction of uterine torsion in camelids has been described[9] and was the method of correction preferred by the authors. As economic value of camelids, specifically llamas, has decreased, nonsurgical methods of correction have been attempted. In this report, we compared results of 3 correction techniques for camelids with uterine torsion.

## Criteria for Selection of Cases

Medical records of New World camelids with uterine torsion admitted to the veterinary medical teaching hospital at Colorado State University between January 1990 and August 1996 were reviewed. Diagnosis was made on the basis of palpation of uterine torsion during celiotomy, transrectal palpation of tautness and dorsal displacement of 1 of the uterine broad ligaments and ventral displacement of the contralateral broad ligament, or transvaginal palpation of a corkscrew-like narrowing of the lumen of the uterus, cervix, or cranial portion of the vagina. Information retrieved from medical records included stage of gestation, physical examination and clinicopathologic data, direction of torsion, method of correction, and status of the cria, dam, and dam's reproductive tract after treatment. Retention of fetal membranes was diagnosed if the dam had not completely expelled fetal membranes within 6 hours of parturition. Subsequent reproductive history was obtained from the owners in the fall of 1996. Direction of torsion was described as clockwise when, as viewed from the rear of the camelid, the left uterine horn was dislocated dorsally and the right horn was displaced ventrally to start the twist and as counterclockwise when the opposite was detected.

## Procedures

**Celiotomy**—Anesthesia was induced by administration of ketamine hydrochloride and diazepam or guaifenesin and was maintained with halothane or isoflurane in oxygen, using a semiclosed circle system. Camelids were positioned in dorsal recumbency after induction of general anesthesia. An 18- to 25-cm incision on the ventral midline was made caudal to the umbilicus, and abdominal viscera were palpated. Direction of uterine torsion was identified, and the uterus was rotated manually to a normal orientation. For cesarean section, the gravid horn of the uterus was exteriorized before or after correction of torsion and was incised along the greater curvature. The fetus was removed, and seromuscular layers of the uterine incision were closed with No. 1 chromic gut or polyglyconate by use of the Utrecht method.[10] The abdominal cavity was lavaged. The linea alba was closed with No. 2 polyglactin 910 in a simple interrupted pattern, subcutaneous tissues were closed with size-0 chromic gut or polyglyconate in a simple continuous pattern, and the skin was closed with nonabsorbable suture or staples. Dams were given antibiotics, nonsteroidal anti-inflammatory drugs, and oxytocin (0.2 U/kg [0.09 U/lb] of body weight, IM).

**Transvaginal manipulation (manual derotation)**—Camelids were sedated with butorphanol tartrate (0.022 mg/kg [0.01 mg/lb], IM) and restrained in a standing position or sternal recumbency. The tail was wrapped and positioned craniolateral to the vulva. The vulva was aseptically prepared. A clinician placed 1 hand through the cervix against the ventrally oriented lateral chest wall of the cria and used the other hand to hold both forelimbs of the cria as they protruded from the dam's vulva. While applying gentle traction on the forelimbs, the clinician pressed the hand against the cria's chest to rotate its body in the direction opposite of the torsion until the uterine position was corrected. The clinician then delivered the cria vaginally, using gentle traction. After delivery, dams were given oxytocin (0.2 U/kg [0.09 U/lb], IM).

**Rolling of the dam with simultaneous administration of external pressure**—Camelids were sedated with butorphanol tartrate, as described previously. All were restrained in right lateral recumbency for correction of clockwise torsion and left lateral recumbency for correction of counterclockwise torsion. A clinician attempted to palpate the position of the fetus through the dam's body wall and then applied pressure with both fists on a point located approximately 5 cm dorsal to the spot at which the fetus was located. One assistant restrained the dam's head, while 2 others rolled the camelid slowly onto its dorsum and then over onto its other side. During rolling, the clinician firmly ballotted the fetus and provided constant pressure on the fetus by alternating position of the fists along the dam's abdomen in the direction opposite the roll. The rolling procedure often was repeated, with each roll taking 2 to 3 minutes. When torsion was corrected, the cria was delivered vaginally with gentle traction, and the dam was given oxytocin as described previously. In those camelids in which the dam was not close to term, the cria was not delivered and oxytocin was not administered.

## Results

During the study period, 33 camelids were admitted for treatment of dystocia. Twenty uterine torsions (60.6% of all camelid dystocias) were diagnosed in 11 llamas and 3 alpacas.

All but 2 camelids admitted were at ≥ 335 days of gestation. Clockwise torsion was diagnosed in 19 camelids; counterclockwise torsion was diagnosed in 1 alpaca. One llama developed torsion in each of 5 successive pregnancies, and 2 other llamas had torsions in 2 successive pregnancies. Recurrence of torsion during the same pregnancy was not detected, but 18 of 20 crias were delivered immediately after correction. Torsion was diagnosed for the first time in primiparous and multiparous dams. Six llamas, representing 12 torsion events, were from the same farm. These 6 llamas consisted of 2 unrelated dams, 3 of their female offspring, and 1 additional unrelated female. Typically, female llamas from that farm had large frames, were in good to excessive body condition (weight, 180 to 225 kg [396 to 495 lb]), and had large crias (birth weight, 15 to 18 kg [33.0 to 39.6 lb]).

Most dams were tachypneic on admission, but other vital signs were considered normal. Results of a CBC were within reference ranges or revealed abnormalities compatible with a stress response. Rumen function, passage of feces, and results of palpation of gastrointestinal viscera were all normal. Serum chloride and sodium concentrations were greater than reference ranges for 3 llamas and less than the reference ranges for an alpaca with mild diarrhea; chloride concentration in a sample of fluid obtained from the C1 compartment of the diarrheic alpaca was within the reference range. Serum bicarbonate concentration was within the reference range for the diarrheic alpaca and 2 llamas; these analytes were not measured in other camelids.

Seven torsions in 7 camelids were corrected via celiotomy. In 1 of these camelids, rolling the dam had been unsuccessful in correcting the torsion. Cesarean section was performed in 6 of 7 camelids that underwent celiotomy, resulting in 4 live and 2 dead crias. Cesarean section was not performed during 1 celiotomy, because the dam was on day 321 of gestation; that dam delivered a dead cria 3 days after celiotomy and subsequently had retained fetal membranes. In 6 camelids that underwent celiotomy and cesarean section, 4 had retained fetal membranes and uterine prolapse. Camelids were treated with fenprostalene (0.001 to 0.002 mg/kg [0.00045 to 0.00091 mg/lb], SC), oxytocin given as a single injection or combined with fluids and administered IV as a constant rate infusion, systemically administered antibiotics, and nonsteroidal anti-inflammatory drugs until membranes were passed. Five camelids became pregnant and had a full-term gestation after surgical correction of uterine torsion. Both camelids that failed to conceive after multiple breedings had had dead crias (1 was delivered by cesarean section, the other was delivered vaginally 3 days after celiotomy).

Five torsions in 3 camelids were corrected by transvaginal manipulation. Four crias were delivered alive, and none of the dams had retained fetal membranes or uterine prolapse. All 3 camelids became pregnant and had a full-term gestation after each of the 5 transvaginal corrections.

Eight torsions in 8 camelids were corrected by rolling the dam with simultaneous administration of external pressure on the fetus and uterus. Dams were rolled 1 or 2 times. Rolling the dam 6 times failed to correct torsion in a ninth camelid, which subsequently underwent celiotomy. Six crias were delivered alive, and 1 was dead. Torsion was corrected in an alpaca on day 300 of gestation, and the alpaca delivered a live cria without complications on day 346 of gestation. None of the dams retained fetal membranes, but 1 dam had uterine prolapse 4 hours after correction. All 8 camelids successfully conceived after correction; 5 had given birth to crias after a full-term gestation, and the remaining 3 were still pregnant at the time this report was written.

## Discussion

Clinical signs of uterine torsion in camelids appear to be similar to those in ruminants with the condition.[1,3-5] Camelids with uterine torsion in our study had signs consistent with colic or dystocia and were usually in the last 2 weeks of gestation (reference range, 342 to 350 days[11]). Diagnosis was easily made after transrectal or transvaginal palpation of the reproductive tract. Normal passage of feces, normal results on palpation of gastrointestinal viscera, and lack of gastrointestinal obstruction as determined on the basis of biochemical analysis of serum or contents of the C1 compartment[12] helped rule out gastrointestinal disease as the cause of colic in these camelids.

Cattle reportedly have a higher incidence of counterclockwise torsion than clockwise torsion.[3,13] Clockwise torsion was much more common in the camelids reported here and has been more frequently reported in Old World camelids.[6-8] This may relate to the reproductive physiology of camelids. Pregnancy in the left horn of the uterus, which can result from ovulation on the left ovary, bilateral ovulation with death of the embryo in the right horn, or migration of an embryo from the right uterine horn to the left uterine horn, is much more common in camelids than are pregnancies in the right uterine horn.[11,14] Clockwise torsion in cattle is more common with pregnancy in the left uterine horn than in the right uterine horn[13]; assuming this is true for camelids, the high frequency of pregnancies in the left uterine horn could explain the plurality of clockwise torsion in the camelids reported here. The source of the embryo in camelids also may play a role in the development of torsion: pregnancy in the left uterine horn that results from ovulation from the left ovary leads to extensive placentation of both uterine horns, whereas migration of an embryo from the right to the left uterine horn often results in placentation of the left uterine horn exclusively.[14] Roles of the source of the embryo or of bilateral ovulations in the development of uterine torsion have not been investigated. Regardless of frequency, the alpaca with a counterclockwise torsion illustrated the importance of accurately diagnosing the direction of torsion before attempting nonsurgical correction.

Unexpected findings included recurrence of torsion in sequential pregnancies in certain camelids and high incidence of torsion in dams from certain family lines on 1 farm. To our knowledge, these findings have not been reported for another species. Damage to uterine supportive structures during 1 torsion may have predisposed the camelid to subsequent torsions, but it is also possible that another factor specific to family lines or farm of origin, such as frequency of bilateral ovulations, high frequency of ovulation on the left or right ovary, large frame size, high body condition scores, or high cria birth weight, may have contributed. In cattle, most of these traits are considered heritable,[15] and high birth weight has been associated with uterine torsion.[16] Although results of the study reported here should not be taken as proof of heritability of uterine torsion in camelids, it seems prudent to warn owners that risk of torsion may be high in subsequent pregnancies or in female offspring of affected dams.

All 3 methods reported here allowed correction of torsion and subsequent delivery of the fetus. Because dystocia in ruminants increases risk of delivery of a dead fetus,[17] retained fetal membranes,[18] and uterine prolapse[19] and causes subsequent infertility,[18] these were expected findings in camelids in our study. Severe maternal complications including uterine rupture and herniation of the body wall were not seen, although uterine rupture has been reported in cattle in which torsion was corrected using the 3 correction techniques,[4] and herniation of the body wall has been reported as a complication of use of caudally located ventral midline incisions in camelids.[20] Complications were more common after celiotomy in camelids reported here, but were not statistically analyzed. Choice of correction technique was made on the basis of circumstances for each torsion, and camelids with more severe or more prolonged torsion may have been more likely to be treated by celiotomy. Because of ease, convenience, economy, and lack of complications, nonsurgical correction techniques, especially rolling, are performed preferentially at our clinic.

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