

Case Report

Retrospective review of dystocia in South American camelids

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Abstract

We describe case management of 30 South American Camelids (7 llamas and 23 alpacas) presented to our tertiary care hospital for dystocia. Assisted vaginal delivery was successful in 80% of llamas and 50% of alpacas. Due to unique camelid anatomy, equid dystocia practices were modified. For llamas and alpacas, neonatal survival rates were 71 and 69%, respectively and nearly all dams (100% [7/7] and 96% [22/23]) were discharged from the hospital. Furthermore, 90% (18/20) of cria survived for at least 1 year. It is important to advise owners of potential complications and the need for rapid and appropriate veterinary intervention (including surgical) if a favorable outcome is desired (for both dam and cria).

Keywords: Dystocia, llama, alpaca, assisted vaginal delivery, cesarian delivery

Introduction

Dystocia in South American Camelids (SACs), as with equid species, is a medical emergency for dam and fetus; however, the unique anatomy (narrow pelvic inlet, vaginal and cervical size) and short parturient window of SACs make handling difficult.^{1,2} Furthermore, forceful uterine contractions lead to premature detachment of fetal membranes and subsequent neonatal hypoxia.³ Understanding techniques and outcomes associated with medical intervention (e.g. vagina and cervix are prone to adhesions) are helpful for appropriate case management.³

Incidence of dystocia is low (1-5% of births) in camelids, with 1% requiring major medical intervention.^{2,4} In comparison, dystocia rates are 8.9% in old-world camelids, 2-7 and 8.5% in dairy and beef cattle respectively and 2-13% in horses.⁴⁻⁷ In camelids, dystocia should be suspected if stage I is > 6 hours or stage II does not progress normally 10 minutes after amniotic sac rupture.^{1,2} Dystocia has maternal and fetal causes. The former include uterine torsion, failure of cervical dilation, uterine inertia, and less commonly, fetomaternal disproportion,¹ whereas the latter are due to malposition (i.e. neck flexion, front and hind limbs flexure) and/or fetal abnormalities.¹

Based on a review of medical records, our objectives were to:
1. quantify the types of dystocia in SACs and their clinical

workup and treatment options provided within a tertiary referral hospital; 2. present a general overview of dystocia procedures and case handling (adapted from equid and ruminant practices); and 3. determine outcomes (short and long-term dam and cria mortality and dam's subsequent reproductive success).

Medical records and data analyses

Medical records of llamas and alpacas admitted to our teaching hospital from 2006 to 2024 for dystocia as the primary complaint were examined. Data on species, age, diagnostics performed, workup prior to presentation, fetal position, medical intervention, days hospitalized, and outcome were collected.

As per the criteria adopted, records of 30 animals (7 llamas and 23 alpacas) were identified. For llamas and alpacas, median age was 8.5 years (8.5 ± 3.6, range 4-15 years and 6.9 years (6.9 ± 3.8, range 3-13 years), respectively, and median weight was 162.7 kg (162.7 ± 13.2, range 152.3-177 kg) and 71.5 kg (71.5 ± 17, range 50-91 kg).

Descriptive statistics and Fischer's exact test (to compare groups) were done with commercial software (GraphPad Prism Version 10.0.0 for Windows, GraphPad Software, Boston, MA).

Observations

Dystocia type

Veterinarians referred 3/7 of llamas and 8/23 alpacas after initial assessments; others were presented due to owners' concerns (4 alpacas were evaluated vaginally by owners) about prolonged parturition. Main reasons for referral were fetal malpresentation and malposition, malposition of fetal extremities (Table 1), and uterine torsion (2 llamas and 3 alpacas).

Analgesia

Local anesthetic was used for analgesia and to facilitate manual vaginal manipulation. An epidural was used in 1 llama and 8 alpacas (2 patients received only sacrococcygeal epidurals, 1 patient received only lumbosacral epidural, and 1 patient received both sacrococcygeal and lumbosacral epidural; lidocaine 2% (VetOne; Boise, ID) and Carbocaine-V (Zoetis; Kalamazoo, MI) were used.

Outcome

In llamas, assisted vaginal delivery (Table 2) was most frequently used (5/7) as a method of delivery, whereas emergency cesarian delivery was necessary in 2/7. In alpacas, assisted vaginal delivery was used in 10/20 and cesarian delivery in 8/20 (Table 2). One alpaca required 3 separate cesarian deliveries (at 3, 5, and 11 years of age). Complications included vaginal and uterine prolapse (n = 3); uterine and vaginal laceration (n = 3); vaginal bleeding (n = 1), body wall hernia (n = 2); and seizures with subsequent death (n = 1).

Therapy

Ceftiofur was the most common antibiotic (18 cases), including ceftiofur sodium (Zoetis) (78.9%, 15/19) and ceftiofur crystalline free acid (Zoetis) (21.0%, 4/19). Florfenicol (Merck; Rahway, NJ) was used in 4 cases and tulathromycin (Zoetis) was used in 2 cases. Regarding antiinflammatory agent, flunixin meglumine (VetOne) was most commonly used (24 cases) whereas meloxicam (Boehringer Ingelheim, Duluth, GA) was commonly used for patients transitioned to an oral antiinflammatory or for those that did not have an intravenous catheter. Additional supportive medications included oxytocin (Bimeda; Le Sueur, MN) (n = 18), domperidone (Dechra Veterinary Products; Overland Park, KS) (n = 9), and a gastroprotectant (n = 5) or parasiticide (n = 5).

Cria survival

Of the llama cria, 71.4% (5/7) were delivered alive whereas 69% (16/23) of alpaca cria were delivered alive (Table 3). For cria that survived delivery, subsequent complications

Table 3. Cria survival status based on delivery type in SACs

	Cesarian surgery (n = 9)	Assisted vaginal delivery (n = 16)	Total (n = 25)
Survival to discharge	6	10	16
Nonsurvival to discharge	3	6	9
p-value	0.69	1.00	-

Table 1. Fetal presentations, positions, and position of fetal extremities in SACs

	Breech (n = 4)	Anterior presentation, dorsosacral position with limb or neck malposition (n = 8)	Anterior presentation, ventrosacral position, hind limbs flexed (n = 1)	Posterior presentation, dorsosacral positioning, hind limb flexed (n = 1)	Posterior presentation, dorsoilial position, hind limb flexed (n = 1)	Total (n = 15)
Survival to discharge	1	5	1	0	0	7
Nonsurvival to discharge	3	3	0	1	1	8
p-value	0.57	0.62	0.47	1.00	1.00	-

Table 2. Fetal positioning and delivery method in SACs

	Breech (n = 4)	Anterior presentation, dorsosacral position, with limb or neck mispositioned (n = 8)	Anterior presentation, ventro-sacral position, with flexed hind limbs (n = 1)	Posterior presentation, dorsosacral position, hindlimb flexed (n = 1)	Posterior presentation, dorsoilial position, with flexed hind limb (n = 1)	Total (n = 18)
Cesarian delivery	1	1	0	1	0	3
Assisted vaginal delivery	3	7	1	0	1	15
p-value	1.00	1.00	1.00	0.17	1.00	-

reported include difficulty nursing (n = 2), failure of passive transfer (n = 6), sepsis (n = 2), and death or euthanasia (n = 4). Congenital abnormalities noted were: blindness (n = 2), bilateral luxating patella (n = 1), bilateral corneal ulcers (n = 1), and cervical scoliosis (n = 1). Surgical correction was attempted in a cria with bilateral luxating patella, but it was euthanized due to lack of improvement and uncontrollable pain. One cria with cervical scoliosis received supportive care at home with passive range of motion exercises performed by the owner, and complete correction was achieved. Overall 4/5 (80%) llama cria and 13/16 (81%) alpaca cria survived to discharge (Tables 4 and 5, respectively).

Llamas were hospitalized for an average of 9.9 days (range 1-39 days). Alpacas were hospitalized for an average of 4.9 days (range 1-30 days); 7/7 llamas and 22/23 alpacas were discharged from the hospital.

Follow up

Follow up information was collected for 24 patients (some was not collected due to inaccurate contact information or calls not returned). Among crias discharged, 86% survived longer-term (> 1 year), including 88%, 14/16 alpaca and 100%, 4/4 llama. In total, 7 female cria (6 alpaca and 1 llama) and 11 male cria (8 alpaca and 3 llama) survived long-term. During follow up phone calls to owners, minimal breeding information was known due to new ownership; however, 2 female alpaca cria were bred with no history of dystocia. Follow up regarding breeding soundness of male cria was limited due to new ownership. Furthermore, 2 owners had castrated their male cria (no breeding soundness information was available).

Of the dams discharged from the hospital and those successfully contacted for follow up, 6 dams were successfully rebred

Table 4. Alpaca cria survival outcomes, based on referral status

	Veterinarian referral (n = 8)	Owner referral (n = 14)	Total (n = 22)
Survival to discharge	4	9	13
Nonsurvival to discharge	4	5	9
p-value	1.00	1.00	-

Table 5. Llama cria survival outcomes, based on referral status

	Veterinarian referral (n = 3)	Owner referral (n = 4)	Total (n = 7)
Survival to discharge	1	3	4
Nonsurvival to discharge	2	1	3
p-value	0.49	0.49	-

whereas 4 dams were not bred due to age (16 years of age) (n = 1), owner preference (n = 2), or medical recommendation (n = 1).

Discussion

Pregnancy length in SACs is 335-345 days² and is 12.5 days longer in spring-bred compared to fall-bred dams.² Clinical management of SACs parturition is important. Typical preparient changes in other species (e.g. mammary gland development, sacropelvic ligament relaxation, and vulval relaxation) are not accurate predictors of parturition in camelids. Additionally, parturition in camelids usually occurs during daytime hours, attributed to their mountainous geographic origins, where birthing in the morning/early afternoon allows drying before the cool evenings.⁸⁻¹⁰ In that regard, 49% of parturitions occurred between 08:00-12:00 hours in a large alpaca farm during an 11-year period.¹⁰ Furthermore, it is theorized that parturition at night is secondary to either an extended birthing process or a pathologic stressor inappropriately triggering parturition.¹¹

Clinicians and owners should be aware of parturition characteristics in SACs. They have 3 stages of labor. Stage 1 labor ranges 3-48 hours and involves fetal repositioning and cervical dilation.² Clinical signs observed include restlessness, isolation from the herd, and increased defecation. Stage II labor (fetal expulsion) should occur within 15 minutes after rupture of the amniotic sac.² Typically, the fetus is oriented in anterior presentation, dorsosacral position, with the head, forelimbs, and neck extended. Stage III labor (fetal membranes expulsion) should occur from 40 minutes to 4 hours after parturition; however, during dystocia, fetal membranes are often expelled with the fetus.² In this study, a majority (8/15, 53%) of cria were oriented in anterior presentation, dorsosacral position, with limb or neck malposition. Within this category of malposition, the most common defect was neck flexion (50%, n = 4), followed by head and bilateral front limb flexion (25%, n = 2), unilateral carpal flexion (12.5%, n = 1), and front limb crossing (12.5%, n = 1).

Clinical signs associated with dystocia in llamas and alpacas vary depending on the primary cause. Equine dystocia principles apply to camelid dystocia; however, camelids have a narrower pelvic inlet; the cervix and vagina are at increased risk of laceration and secondary adhesions compared to equids; and crias are at increased risk of hypoxia due to forceful uterine and abdominal contractions.¹² Overall, special care is needed when attempting assisted vaginal delivery in SACs undergoing dystocia, to minimize iatrogenic trauma to the dam.

Understanding the inciting cause of dystocia is important in providing appropriate assistance. Dystocia of fetal origin is most commonly associated with fetal malposition, typically carpal or shoulder flexure or head deviations.^{1,2} In this report, none of the cria were in anatomically correct positions. A full assessment of fetal position, viability (difficult to access in SACs), and the clinical picture of the dam should be taken into consideration before attempting vaginal delivery.¹ It is important to ensure that the dam's cervix, vulva, and vestibulum are fully dilated.² If the fetal position does not allow manual manipulation (i.e. breech, transverse presentation, or severe head deviations), it is recommended to proceed straight to cesarian delivery.¹ If the cria has mild limb or neck flexions, assisted vaginal delivery may be attempted only if the vulva, vestibular-sphincter, and cervix are all fully dilated.¹

Fetal manipulations be limited to 15-20 minutes, due to the high risk of vaginal tears.² Authors find it helpful to start a timer at the beginning of fetal manipulations, to ensure a timely transition to alternative methods if no progress is made.

Fetus should be manually manipulated to align the fetus to the largest part of the dam's pelvis. If retropulsion is needed, elevating the hind limbs of the dam may be necessary, in conjunction with heavy sedation plus epidural analgesia and/or general anesthesia.^{1,2} Additionally, depending on the patient's analgesia level, there is a concern for secondary fetal hypoxia.² Manual manipulation predisposes to development of vaginal adhesions (a complication that should be prospectively communicated to owners).² Manual manipulation is performed under epidural anesthesia; either the first coccygeal intervertebral space or the sacrococcygeal intervertebral space depending on clinician preference.^{13,14} Areas that are desensitized by caudal epidural include tail, anus, rectum, urethra, vagina, and vulva.¹³ Before vaginal examination, rectal examination is recommended when possible.¹² To prevent tears and iatrogenic trauma, use abundant lubricant (with lidocaine) in the rectum to promote relaxation and reduce straining.¹² For SACs patients, lidocaine recommended dosage is 0.2 mg/kg with a maximum total dose of 4 mg/kg^{1,15,16} (maximum of ~ 2 or 2.5 ml of lidocaine per llama or alpaca, respectively).^{1,15} Signs of lidocaine toxicity include ataxia, increased respiratory effort, tachypnea, weakness, hypotension, and altered mentation.¹⁶ Rectal examination will assist in identifying the location and direction of uterine broad ligaments, for evaluating abnormalities (urinary bladder, pelvic region, and kidneys) and identifying uterine torsion.¹² Antimicrobial and antiinflammatory medications should be part of routine supportive care. Most commonly used antimicrobial was ceftiofur and flunixin meglumine was the most commonly used antiinflammatory agent, similar to another retrospective report.¹⁷

If assisted vaginal delivery is not an option, cesarian delivery is recommended. Increased duration of dystocia is associated with increased fetal and dam mortality in camels.⁴ The sooner a cesarian surgery is performed (recommended maximum 20-minutes of fetal vaginal manipulation), the fewer complications and better tissue viability.¹¹ Cria survival was not affected by delivery method, with 67% (6/9) of cria delivered via cesarian survived to discharge in this case review.

Surgical approaches in camelid species include left flank and low flank/ventrolateral and ventral midline, with left flank being common.¹⁴ For uterine torsion, a ventral midline incision under general anesthesia is recommended.¹⁴ Complications of cesarian surgery include peritonitis, incisional seroma, hemorrhage, infection, dehiscence, and/or incisional herniation.¹ Complications are best minimized with good surgical techniques (careful tissue handling, appropriate homeostasis, and good apposition/reconstruction during closure).¹ Fetal membranes are removed during closure of the uterus; however, if they can be easily removed from the uterus, they may be removed at surgery.¹ Care should be taken during closure not to include fetal membranes in the uterine wall closure, due to the microcotyledonary placental structure.¹ Place an abdominal support band for 10-14 days to promote abdominal wall integrity and prevent complications.¹ Of the 9 patients that underwent cesarian surgery in this review, 1 llama did not have a belly band placed and the owner reported

that a body wall hernia occurred after discharge. Of the 9 cesarian deliveries, only 2 patients had complications; 1 had a body wall hernia and 1 died due to postoperative complications.

Hospitalization requirements vary, depending on dam and cria needs. Retained fetal membranes after cesarian surgery are not uncommon (12.5%), can be managed medically (with oxytocin) and shedding usually occurs within 24 hours.^{14,15} However, it is important to ensure that the cervix is open.¹⁶ Side effects of oxytocin include abdominal pain (i.e. colic) and patients should be monitored closely after treatment.¹ After cesarian delivery, 75.9% of dams were rebred and conceived again, implying breeding potential was not compromised in a majority of patients.¹⁴ In our population (where follow up was possible) 6 dams were successfully rebred, whereas rebreeding was not pursued with 4 dams.

Cria survivability after dystocia is important. At parturition, cria have increased fetal cortisol concentrations that promote surfactant production and increase catecholamines. However, this surge can subsequently mask clinical illness at birth or shortly after.¹⁶ Half of cria deaths occurred within the first week, emphasizing routine monitoring and supportive care, especially after dystocia.² Following delivery, a physical examination is critical to assess cria stability and to detect congenital abnormalities. Routine supportive care included camelid plasma transfusion if indicated, weight monitoring every 24 hours, dipping the umbilicus in disinfectant (chlorohexidine solution), nursing with milk replacer if necessary, and catheter care. It is recommended to test IgG concentrations; due to high variability between assays, use 1 method consistently for any patient.¹⁷

Our review of medical records was focused on the clinical practices used for the workup and care of dystocia patients presented to a tertiary care hospital. Limitations included missing information (e.g. dam weight, height, breeding history, pelvic width, and sire dimensions). Furthermore, as some patient care was lost to follow up, there may be some inaccuracy in long-term survivability and breeding of the dam and cria. Due to high selling/adopting rates of cria within our demographic population, long-term survival was deemed at 1 year to facilitate follow up (extending this interval would provide more information). Although we were only successful in gathering reproductive abilities of 1 female cria, future studies exploring their success is important, as many cria are sold as breeding stock in this region.

The small sample size in comparison to the overall SACs caseload of this tertiary referral hospital was surprising, but may attest to the infrequent nature of dystocia in SACs. In 2024, our teaching hospital had an average caseload of 97 SACs/year compared to an average of only 1.7 SACs dystocia cases.

Further investigations into the long-term survivability of cria and their breeding soundness after dystocia would be beneficial to educate owners and to make proper treatment decisions. Additionally, as information regarding duration of dystocia was missing in many medical records evaluated, a future study investigating the relationship between dystocia duration and interval to patient assessment would better inform how intervention interval impacts patient outcome. Furthermore, understanding individual predisposition for dystocia would benefit both owners and clinicians.

Conclusion

Effective case management of SACs dystocia requires swift action, appropriate knowledge of species anatomy and physiology, and species-specific approaches; when these practices are put into place, a favorable outcome is likely. It is evident from this report that favorable outcome and cria survival were, in general due to veterinarians' and owners' awareness of abnormalities in parturition, comprehensive case workup at the hospital, and effective case management (assisted vaginal delivery or cesarian delivery). Cria survival did not differ between assisted vaginal delivery and cesarian delivery, was not affected by fetal malposition, with many still alive after at least 1 year later. Finally, with appropriate management, dystocia in SACs has excellent prognosis for dam and cria.

Conflict of interest

None to report.

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