Angel's Not Kidding Around

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Introduction

Dystocia, or difficult birth, is a major cause of economic loss in the small ruminant industry. Though the worldwide incidence is considered low at less than 5% (with goats considered to be higher than sheep), the various negative outcomes that can occur drive those economic losses and hurt the producer no matter the level of incidence within their respective flock or herd[4]. Losses can be attributed to loss of the newborn, loss of the dam, and/or negative effects on the dam's future fertility and productivity in the flock or herd[4,6].

Dystocia typically occurs when either the first or second stages of labor fail to progress normally. Stage one labor is characterized by the animal separating itself from the group, showing signs of restlessness, and loss of appetite. As the first stage progresses and transitions to the second stage, more forceful abdominal contractions become apparent with the second stage mainly characterized by the process of the expulsion of the fetus(es). Stage three is characterized by the expulsion of the fetal membranes. The duration of each stage and therefore labor as a whole is variable. However, it is generally accepted that stage one can last anywhere between 2 and 12 hours prior to delivery though 24 hours is not uncommon. Stage two of labor should occur pretty quickly and be completed within 1 to 2 hours. And finally, stage three should occur within 6 hours after parturition[2].

As mentioned, any failure to normally progress through these stages in the accepted time frame warrants veterinary examination to determine the cause and to manage or treat the dystocia appropriately. Causes of dystocia can be classified as either maternal or fetal with regards to which individual is to blame for the failure to progress. Maternal causes of dystocia are considered to be more common (~64%) compared to fetal causes (~37%) and include incomplete cervical dilatation, uterine torsion, narrow pelvis, and secondary uterine inertia with incomplete

cervical dilatation being the most common (~42%)[6]. Fetal causes include fetal malposition, fetal monsters, and oversized fetuses with malposition being the most common (~46%)[6]. Following determination of the cause, veterinary management and treatment can be directed to save the lives of both the dam and the fetus.

History and Presentation

Angel, a 2 year old Nubian doe used for milk production, presented to MSU-CVM Food Animal Services on March 15, 2021, following a history of straining and contractions for over 24 hours with no progression. The owner noted that Angel had been distancing herself from the herd the morning prior and she was uninterested in feed which included dairy pellets and ad lib grass hay. The day of presentation, Angel was noted to still be having contractions and straining with no progression. At this time, she had also developed a thick discharge. The owner also reported that this pregnancy had been difficult with Angel showing two previous signs of attempting to abort the pregnancy with very similar presentations. Angel was due to give birth within the next week, indicating this was likely labor and not an abortion attempt and so she was brought in to be evaluated. Angel had successfully kidded in the past.

On presentation, Angel was quiet and alert. Her vital parameters included tachycardia characterized by a heart rate of 144 beats per minute (normal of 60-100), tachypnea characterized by a respiratory rate of 60 breaths per minute (normal of 20-50), and a mild elevation to high normal in rectal temperature at 103.1ºF (normal 101.5ºF-103.5ºF). On cardiothoracic auscultation, no crackles, wheezes, murmurs, or arrhythmias were appreciated. Her mucous membranes were pink and moist with a capillary refill time of less than 2 seconds. She was in near ideal body condition (3/5) and her FAMACHA score was a 2/5. Normal rumen sounds and contractions were also appreciated on abdominal auscultation with 1-3 strong

contractions being expected. Her mammary glands were well developed with milk present. Brown, cloudy, and thick vaginal discharge was present. Vaginal speculum examination revealed a closed cervix with fluid pooling in the vagina. Examination via transabdominal ultrasound revealed at least two viable fetuses. The remainder of her physical examination was unremarkable and within normal limits.

Differential Diagnoses

Following examination and evaluation of the history provided, it was decided that Angel was likely experiencing dystocia being that she was in labor with failure to progress normally. Though an exact cause could not be determined immediately upon presentation and examination, multiple possible causes were present. Given the prolonged history of straining and contractions, differentials such as fetal malposition, fetal monster, and an oversized fetus were on this list. However, also given the lack of cervical opening, incomplete cervical dilatation was considered as well as other maternal causes such as uterine inertia; uterine torsion could not be ruled out because the cervix was closed preventing full examination of the uterus. Some of the other dystocia causes mentioned above were less likely such as narrow pelvis due to Angel's previous history of successful kidding. With all of that in mind the list of possibilities (in order of likelihood) became incomplete cervical dilatation, uterine inertia, fetal malposition, oversized fetus, fetal monster, and uterine torsion.

Diagnostic Approach

The diagnostic approach to any dystocia should first include examination by a veterinarian of the animal as a whole followed by an examination of the birth canal and fetus, if possible, to determine the cause. Physical examination can lead to the identification of more systemic issues that can hinder normal parturition including but not limited to any type of

metabolic or musculoskeletal abnormalities. Manual observation via a vaginal speculum can give an idea with regards to the cervix, and if dilated, vaginal palpation can clue the veterinarian in on any fetal causes of dystocia such as malposition or size, among others[2,4].

Given some of Angel's presenting observations, a definitive diagnosis of the cause of her dystocia could not be made given the inability to fully evaluate the birth canal, and therefore fetus(es), other than identifying their viability via ultrasound. At this time, given the incomplete cervical dilatation, the concern became that this was the cause of Angel's dystocia. It was decided to induce Angel's labor and monitor her progress. This approach would allow incomplete cervical dilatation to be ruled in or out as the primary cause of the dystocia. Should Angel then progress with regards to cervical dilatation, and she still fail to progress normally, further evaluation of the birth canal and fetus(es) would be warranted to further characterize the specific cause for the failure to progress.

Angel was induced upon presentation with the widely accepted protocol of a steroid (dexamethasone at 20 mg/kg intramuscularly) and prostaglandin (Lutalyse ® (dinoprost tromethamine) at 25 mg intramuscularly). Angel began to have more abdominal contractions and an increased respiratory effort and rate. Approximately 4 hours later, another vaginal speculum examination was performed, and the cervix had only slightly dilated. Abdominal ultrasound revealed that a viable fetus was still present. Due to her failure to dramatically respond, a chemistry was run to rule-out any other potential issues not appreciated on physical examination.

The bloodwork was overall fairly unremarkable. The only abnormalities of note were a moderate hyperglycemia of 117 mg/dL (49-76 mg/dL) (attributed to stress), moderate elevation in BUN of 33 mg/dL (9-21 mg/dL), moderate to severe hypophosphatemia of 2.3 mg/dL (=

6.6mg/dL), and a mild increased total bilirubin of 0.4 mg/dL (0.0-0.2 mg/dL). Given the low phosphorus, 20 mg of monosodium phosphate orally was started.

The following day, Angel still had not given birth and so serial ultrasounds were repeated to assess fetal viability. Multiple fetal heartbeats were appreciated on abdominal ultrasound, and they did not appear to be in any distress. Digital palpation of the vagina and cervix revealed that Angel had slightly dilated more to a width of three to four fingers. The prostaglandin was re-dosed at the same dosage.

The next day, Angel showed no progression in terms of cervical dilation and only one hoof could be palpated in the birth canal. Abdominal ultrasound revealed no viable fetal heartbeats and so a caesarian section was performed. Unfortunately, three deceased kids were delivered. Angel recovered uneventfully and was started on antibiotics including Naxcel ® (ceftiofur sodium at 20 mg/kg subcutaneously), procaine penicillin G (44,000 IU/kg subcutaneously), Banamine ® (flunixin meglumine at 1.1 mg/kg intravenously), and oxytocin (0.25 mLs intramuscularly). Angel was discharged from the hospital after two days of monitoring and treatment following her caesarian section with no post-operative complications observed. She was discharged with instructions to continue her procaine penicillin G, ceftiofur sodium, and meloxicam (1 mg/kg orally) and to report any issues or concerns.

Given the progression of events, a likely diagnosis of incomplete cervical dilatation, also known as ringwomb, was suspected.

Pathophysiology

Ringwomb, or incomplete cervical dilatation, is failure of the cervix to dilate appropriately at the time of parturition. It is most commonly encountered in the ewe and to a lesser extent in the doe with no predisposition attributed to any breed, age, or body condition

score. It is considered to be a heritable condition, and therefore, any female offspring intended to be used for breeding are considered at increased risk for failure of cervical dilatation and may be candidates for caesarian section. Producers may want to consider removing these animals from the herd prior to breeding to eliminate the risk[2,3,5]. A similar condition has also been described in which the cervix is not appropriately stimulated to dilate due to a disruption in the normal birthing process[2].

In the case of ringwomb, the exact etiology has yet to be determined. Two viable propositions include a failure of secretion of the hormones that control labor or failure of the tissue to respond to the hormonal secretions. One reason that is has been challenging to confirm an exact etiology stems from the widespread failure to produce ringwomb in controlled, experimental studies. This has led to a significant lack in the ability to study the process. One study did achieve a ringwomb-like condition in sheep by administering higher than physiologic levels of progesterone daily. This study found that the time to parturition was extended, and dilatation of the cervix was slow with doses of progesterone, but the ewes were able to successfully have their lambs without assistance[5].

Another attempt to determine the etiology was done by researching the effect of relaxin. It was thought that relaxin, which works by causing dissolution and depolymerization of collagen tissue, would help to soften and therefore dilate the cervix. This has been used in humans and other species successfully to dilate the cervix though it was found in sheep to not be of practical value due to the fact that progesterone can stimulate the release of relaxin but has little effect on tissue that is not estrogenically sensitized. As caprine and ovine cervices are fibrocartilaginous, this fails to be of much practical value as estrogen has no effect on fibrocartilage[5].

Another attempt was made by studying the effect of prostaglandin, specifically PGE_2. It was thought that treating the cervix by applying PGE_2 as an intracervical gel would yield softening of the cervix, allowing dilatation as seen during spontaneous parturition. The application of prostaglandin did not soften the cervix and allow dilatation, so a defect in prostaglandin response could not be considered the definitive cause[5].

Further studies are being attempted to fully determine the complete pathophysiology associated with ringwomb in small ruminants. These studies are necessary given the clinical relevance of the disease process as it is being increasingly identified as the cause of dystocia in small ruminants. The potential economic losses also compel the research as to eliminate or at least decrease those losses. It is important to note that the completed research has revealed several weak predisposing factors such as hypocalcemia, hormonal or mineral imbalances, twinning, season, and breed that should continue to be studied and managed appropriately[5].

Treatment and Management Options

Without an exact cause for the presentation of ringwomb, a direct medical treatment has not been identified. Therefore, treatment is directed at saving the fetus(es) and the dam before any negative prognostic sequelae can occur.

Manual dilation of the cervix can be first attempted but often times is unrewarding and can lead to cervical and/or uterine tear. If you suspect hypocalcemia, a mineral imbalance, or some other cause, then the practitioner could attempt to supplement the dam or induce parturition directed at that cause. However, most of the time, this also fails to yield rewarding results in the case of ringwomb[1,2,3,5].

The most common treatment in the case of ringwomb lies in caesarian section performed at the first sign of dystocia due to improper cervical dilatation[1,2,3,5]. There are multiple

approaches to caesarian section in the small ruminant, but the most common will be discussed here. Overall, it is important to note that while a hospital setting is ideal with regards to better results and fewer complications, field caesarian sections are often done with great success. In fact, the transportation of the individual animal to a hospital increases the time to surgery endangering the lives of the fetuses and the dam[2].

The standing, left flank approach can be done in either a hospital or the field. The patient is not sedated or anesthetized for this procedure so as not to affect the fetuses *in utero*. To start, a caudal epidural of 2% lidocaine (0.5 mg/kg) administered in the space created by the fifth sacral and first coccygeal vertebrate provides local anesthesia. A lumbosacral epidural (administered in the space of the sixth lumbar vertebrate and first sacral vertebrate) is used in sheep as they commonly lack a tail for appropriate administration guidance of the caudal epidural. Regardless of location, these areas need to be clipped and surgically prepped using chlorhexidine and alcohol. The left paralumbar fossa is clipped and surgically prepped in the same manner. A line block of 2% lidocaine is also administered along the proposed surgical incision to further provide more local anesthesia. It is critical to not exceed the toxic dose of lidocaine of 6 mg/kg when using the drug for local anesthesia[2].

Once the patient is fully restrained, draped in, and ready for surgery a skin incision is made along the line block or just slightly lateral to it. The incision is then made deeper through the cutaneous trunci muscle, external abdominal oblique muscle, internal abdominal oblique muscle, and the transversus abdominis muscle being careful to not incise through the peritoneum until ready to enter the abdomen. Once ready, an incision can be made into the peritoneum to allow entrance to the abdominal cavity. Along this process of dissection, the scalpel blade or

Metzenbaum scissors can also be used to carefully dissect the muscles and/or extend the incision[2].

Once into the abdomen, the clinician then palpates the abdominal structures to locate the gravid uterus. After the uterus is located and the hock of the lamb or kid has been identified, it can easily be exteriorized in small ruminants. Sterile towels then should be used to pack off the surrounding area before incising the uterine wall. An incision is then made from the hock to the hoof of the fetus being careful to not cut the fetus. The clinician then grabs the hindlimbs of the fetus and removes it from the body quickly as to tear the umbilicus as it would during natural parturition. It is most helpful to have multiple assistants that can be ready to care for the neonate and follow through with resuscitation while the clinician continues the surgical procedure[2].

Following removal of the first neonate, it is absolutely critical to re-enter the uterus and palpate to ensure no more fetuses remain. If additional fetuses remain, repeat the process as before, ideally through one uterine incision; however, multiple incisions can be made if the fetus cannot be manipulated through the same incision. Once the clinician is comfortable that all fetuses have been removed, the uterus can be closed[2].

The uterus is closed with absorbable suture in an inverting pattern. Any inverting pattern is acceptable such as Utrecht, Cushing, or Lembert as long as a watertight seal is achieved. If there is any question as to the integrity of the closure, the incision can be oversewn with the same pattern or another inverting pattern. The uterine body should then be copiously lavaged with saline as to remove any blood and debris from the surgery. The uterus is then returned to the abdomen and the body can be closed. Absorbable suture should be used to again close the peritoneum and transversus abdominis muscle in one layer using a simple continuous pattern followed by the internal abdominal oblique, external abdominal oblique, thin layer of cutaneous

trunci muscle, and subcutaneous tissue in a second layer again in a simple continuous pattern this time taking a bite of the underlying layer to close any potential dead space. Finally, the skin should be closed with a non-absorbable suture in a Ford interlocking pattern, also including underlying tissue to close potential dead space[2].

Post-surgery, the area around the incision is cleaned and then an aerosol bandage such as an aluminum-based spray can be used to further seal the incision. The most common post-operative complication seen is retained placenta; however, other complications are usually minimized when the dam receives perioperative antibiotics. Oxytocin can be used to encourage uterine involution and expulsion of any placenta that remains behind. Antibiotics such as procaine penicillin G and ceftiofur sodium can be used to prevent infection or complications. Flunixin meglumine can be used as a non-steroidal anti-inflammatory for pain and inflammation followed by oral meloxicam while the dam recovers[2].

The sutures should be removed in about 14 days and during the visit a full recheck examination should occur to ensure that the dam is healing appropriately with no signs of lingering complications. At this time an examination of any live offspring can also be performed though an initial examination should be performed shortly after birth.

Expected Outcomes and Prognosis

In the case of dystocia as a whole and even with regards to ringwomb the expected outcome and prognosis is variable depending on various factors such as time in labor and the cause of the dystocia among many others.

For small ruminants experiencing ringwomb, an expected outcome if the dam has achieved an adequate gestation length of at least 142 days (normal 147-150) and a caesarian section is performed as soon as possible will be survival of both the dam and the fetuses[1,2,3,5]. Of

course, loss of the fetuses can occur as well as loss of the dam given complications and other situations.

The prognosis for survival of the fetus(es) is good to guarded depending mainly on the length of labor and stage of gestation. Given appropriate timing and adequate neonatal resuscitation, the prognosis can be good to great. As far as the dam is concerned, prognosis is usually good to great again as long as appropriate timing of the surgery is achieved and post-operative complications are minimized and treated appropriately[2].

Ringwomb characteristically has not affected fertility the following breeding season and usually does not occur in consecutive parturitions though it has been reported[5]. Overall, it is recommended for the producer to consider culling these animals, as well as any offspring, from the herd or flock to eliminate the risk of dystocia and complications in later breeding seasons [5].

Conclusion

Though dystocia carries a fairly low incidence worldwide in small ruminants, when it does occur the producer is faced with economic loss[4,6]. No matter the cause, of which there are many, including maternal and fetal factors, multiple lives are at stake.

Appropriate detection of dystocia and the cause are necessary to pursue treatment to ensure the lives of the dam and the fetuses. With ringwomb, there is incomplete dilatation of the cervix with a still to be discovered pathophysiology[5]. Manual dilation as well as other treatments such as hormonal stimulation and electrolyte corrections can be attempted though are often times unrewarding. Caesarian section is the treatment of choice in this situation to maximize the chances of having a healthy dam and newborns[1,2,3,5]. Post-operative complications are fairly minimized with appropriate surgical technique and medical management[2]. Though the prognosis varies due a variety of factors it can be a very rewarding process if appropriate action is taken.

Further studies and research are warranted to discover the exact etiology and pathophysiology of this process so future cases can be prevented or managed and treated appropriately.

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