Small Ruminant Dystocia

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Abstract

Dystocia's in small ruminants are considered uncommon. Owner intervention often leaves the veterinarian with a disaster and potentially unreasonable expectations. Determination of the most important component, dam, fetus(es), or both, and economics ultimately makes the veterinarians focus more defined. Utilization, availability, and comfort of drugs (anesthetics, analgesics, anti-inflammatories, and antibiotics) can be a source of frustration in these cases.

Keywords: Dystocia, small ruminant, c-section, neonate, colostrum

Introduction

Small ruminants are being kept as both production and pet livestock with current estimates in the United States of 5.02 million sheep and 2.51 million goats, respectively.[1] Emergencies, specifically dystocia, will arise and owners will consult social media, contact a veterinarian, intervene, and then ultimately present to the veterinarian. Owners with production small ruminants will likely have a very defined and tight breeding season, while pet owners may not. Timely intervention in dystocia cases likely provides a more favorable outcome for both the dam and fetus(es). Pre-and post-partum care of the dam and neonates is imperative to ensure health and livability.

Gestation Length and Maintenance of Pregnancy

Herd health, adequate nutrition, and previous dystocia's should be evaluated in the pre-partum female. Pet versus production will likely influence the retention of a female that has had multiple dystocia's. Vaccination (specifically with *Clostridium perfringens* type C & D and *Clostridium tetani*), FAMACHA scoring, and other stressful procedures (sheering, hoof trims, etc.) should be completed 3-4 weeks prior to the anticipated parturition. Exact breeding dates and anticipated breeding dates are not always easy to determine. Use of marking harnesses or grouping does/ewes can give a more defined lambing/kidding season in larger herds. Removal of the sire will also dictate a defined interval for parturition.[2]

Gestation length in the ewe and doe is 5 months. Ewes range in length from 145-150 days, while does range from 147-155 days.[2,3] Small ruminants have an epitheliochorial, cotyledonary placentation making the neonate agammaglobulinemic. Pregnancy in the doe is maintained by the corpus luteum (CL) throughout gestation. In contrast, maintenance of pregnancy in the ewe is both via the fetoplacental unit and CL depending on the stage of gestation.[2]

Parturition

Normal initiation of parturition occurs when there is no longer adequate room in the uterus for the fetus(es). Of course, this takes place through a series of pathways. The fetal pituitary-adrenal axis triggers parturition. Release of adrenocorticotropic hormone from the fetal pituitary gland stimulates release of corticosteroids from the fetal adrenal gland.[2,4] This increase of fetal cortisol stimulates placental estrogen production. Prostaglandins (PGF2alpha) are released from both the placenta and endometrium inducing luteolysis, resulting in decreased progesterone. Myometrial

activity is stimulated via the release of prostaglandin and ultimately beginning the parturition cascade.[2,4]

Impending signs of parturition include udder development, restlessness, segregation, relaxation of the sacrotuberous ligaments, vulvar discharge, enlarged or edematous vulva, tail flagging, and nesting.[3] Parturition is divided into three stages. Stage one is characterized by cervical softening with myometrial contractions leading to cervical dilation.[5] This stage can last from 2-12 hours depending on parity and ends when the chorioallantois ruptures. Once the fetus enters the pelvic portion of the reproductive tract stage two labor is initiated.[2,3,5] Stage two is accompanied by forceful abdominal contractions, expulsion of allantoic fluid, and delivery of the fetus.[5] Third-stage labor begins immediately after delivery of the last fetus and ends with expulsion of the fetal membranes. The placenta should be passed within four to eight hours depending on species and most small ruminants will pass the placenta within 15-20 minutes of giving birth.[2-6]

Dystocia

Dystocia is defined as slow or difficult labor.[5,7] Animals in dystocia do not progress appropriately from stage one to stage two, through stage 2, or signs of labor are missed by the owner/producer. Most commonly dystocia results from fetal mal-posture, fetal-maternal mismatch, inappropriate cervical dilation, multiple fetuses presenting at once, and fetal malformation or one of the 3 “P’s.”[5,8] Uterine torsion, uterine inertia, pregnancy toxemia, hypocalcemia, and vaginal prolapse can be causes of dystocia in small ruminants.

The three P’s of dystocia are presentation, position, and posture. Presentation refers to the relation of the fetal spine to the dam.[9] Normal presentation in the small ruminant is cranial OR caudal longitudinal. Abnormal presentation would be dorsal or ventral transverse. Position

relates to the dorsum of the fetus with regard to the quadrants of the dam's pelvis.[9] The pelvis of the small ruminant can be thought of as quadrants including sacrum, right or left ilium, and pubis. Normal position is dorsosacral. The final "p" is posture and describes the relationship of the extremities in respect to the fetal body.[9] Normal posture would be that the forelimbs and head are extended. Finally, the normal presentation, position, and posture is cranial-longitudinal dorsosacral with the head and forelimbs extended.

Note:

1. Caudal-longitudinal presentation in the small ruminant is considered normal as long as both hindlimbs are extended.

2. Small ruminant fetus(es) can often be delivered with one forelimb retained.

Owner awareness and understanding of dystocia is important. In well managed herds, the breeding or parturition dates are often known, but this isn't necessarily true with pets. Intervention and timing in dystocias are crucial for both veterinarians and owners. Often, the mentality is the faster I can intervene the better, but the reality may be that the dam did not need help and the intervention may have worsened the outcome. A good rule of dystocia is the 30-minute rule with the understanding there are always exceptions.

30-Minute Dystocia Rule[8]

1. Wait 30 minutes until after the chorioallantois (water bag) has ruptured or abdominal press (contractions) is present
2. Fetal presentation normal – wait another 30 minutes before fetal manipulation
3. Wait another 30 minutes to check for multiples ("spares") after a normal delivery

Exceptions to this rule include yellow staining that indicates meconium, placenta passing without evidence of a fetus, non-progression, and presumed fetal distress.

Many dystocias can be corrected with transvaginal palpation and manipulation. Pelvic size of the dam and the obstetricians hand are two rate limiting factors that should give practitioner's pause. As with any dystocia, all manipulations or mutations should follow general cleanliness, lubrication, and gentleness.[2]

Evaluation/Preparation

Whether the doe/ewe is presented to you in a hospital or on an ambulatory call, the examination is still generally the same. Historical questions should include parity, previous dystocias, vaccination, deworming, treatments, breeding date, and any manipulation that has occurred on farm. It is important to remember that disease and dystocia can look similar in their presentations and sometimes breeding dates are unknown. The risk of zoonotic disease in small ruminant dystocias is high and personal protective equipment should be utilized. Often owners think that the doe/ewe is "overdue" but in reality this may not be the case. Baseline physical examination should be performed to determine patient stability. Blood parameters (blood glucose and ketones) and a quick ultrasound scan can be performed to evaluate fetal viability.

Preparation of the dam is clinician dependent but the principles of cleanliness and personal protection should be common across practitioners. The author performs either a sacrococcygeal or lumbosacral epidural before any palpation is performed.

The sacrococcygeal epidural is best utilized in those animals with a tail, such that the space can be easily palpated. The area of the tailhead is clipped and prepped with scrub (betadine or chlorhexidine) and alcohol. This epidural is performed at the sacrocaudal or the first

intercoccygeal space. Needle size is dependent on animal size but typically an 18- to 21-gauge, 4-cm needle is acceptable. The needle is placed through the skin and the “hanging drop technique” is utilized. The hub of the needle is filled and advanced in a cranioventral direction. The anesthetic should be drawn into the space. Doses for the sacrococcygeal epidural are 1ml/15-50kg body weight.[10] The sacrococcygeal epidural will allow for manipulation within the vulvovagina, but the practitioner should not expect that it will provide anesthesia to the flank.

The author prefers to perform the lumbosacral (LS) epidural with all small ruminant dystocias especially if there is potential for C-section. The LS space is located in a depression palpated on midline from a transverse line drawn with the wings of the ilium.[10] (See Image) Performing the LS epidural requires that the practitioner be directly on midline. The space is clipped and prepped similarly to the sacrococcygeal space. A 3.75cm – 7.5cm, 21-gauge needle is typically used for small ruminants. The needle is placed through the skin, the “hanging drop technique” is utilized, and the needle is advanced until the anesthetic is drawn into the space or cerebrospinal fluid is flowing from the needle. Often times a “pop” will be felt when the needle passes through the interarcuate ligament and the anesthetic is drawn into the space. If the “pop” is missed and cerebrospinal fluid is present, an intrathecal LS epidural is still acceptable.[11] LS epidural doses range from 1ml/10-20kg of body weight. The author typically will use 1ml/10kg. The dose for intrathecal administration is 1mg/kg or 1ml/20kg of body weight.[10,11]

Once the epidural is in place, the vulva is cleaned with betadine scrub and water or ivory soap and water. Use of gloves and lubrication is imperative in small ruminants. Obstetrical manipulation may be limited because of the practitioner’s hand or patient size. If a tail is present, it should be held up such that contamination is minimal. The hand is cupped and introduced into the vulva to determine if the fetus(es) can be extracted vaginally. Pelvic size of the dam, cervical

dilation, and fetal size will likely influence whether a vaginal delivery is acceptable. If vaginal examination reveals a tight ring of tissue, the cervix is either closing or still dilating and one should not attempt to shove their hand through this opening. Misoprostal may, but most likely will not assist with dilation of the cervix due to the cartilaginous rings of the cervix. If the practitioner can safely go through the cervix, then fetal manipulation must occur. Fetal manipulation includes determining the "3 P's" and then trying to correct the abnormalities. The author will utilize bailing twine, dog leashes, or fingers as obstetrical chains. Make shift head snares can also be made with these devices. Similarly, rules apply with one loop above and a half-hitch below the fetlock when placing "chains." As with any dystocia, once traction has started, there must be progress. Small ruminant fetus' often can be pulled with one forelimb retained, if the head and other forelimb are progressing normally. Caudal presentation is also an acceptable way for the small ruminant fetus to be extracted. If the fetus appears to be "stuck" in the canal or half of its body is protruding and it will not budge with significant traction, then other options are necessary. This "stuck" sensation could mean there is a uterine or cervical tear, and the more traction placed the worse the tear could become.

If vaginal manipulation and traction are unsuccessful next steps should be considered. C-section, fetotomy, terminal c-section, and euthanasia are all viable options. C-section can be performed utilizing the left or right flank (not recommended), ventral midline, or the paramedian approach. The author's preference is to do the procedure from the left flank. The following steps are performed when doing a small ruminant c-section in this manner.

1. Weight of the patient, calculation of toxic dose (6, 7, 10mg/kg) lidocaine, IV jugular catheter
2. Lumbosacral epidural – 1ml/10-20kg of body weight

3. Clip and quick prep of the left flank
4. Inverted L block in the left flank utilizing remainder of lidocaine from toxic dose calculation
    a. Often will dilute to make the lidocaine a 1% solution (C1V1=C2V2)
5. Inverted L block should be performed with respect to where the incision will be made
6. Final prep of the surgical site and gathering of surgical equipment needed
7. Flow-by oxygen hooked up and ready
8. Drugs – I don't use all of these!
    a. Midazolam or Diazepam – 0.2-0.4mg/kg IV before blocking of the left flank and can be re-dosed in surgery
        i. If the epidural and block are effective redosing may not be necessary
        ii. Reversal - Flumazenil
    b. Butorphanol or Morphine – 0.1 – 0.4mg/kg IV, IM, SQ
        i. Can be utilized for pain and sedation
        ii. Reversal - Naloxone
    c. Ketamine 1-5mg/kg IV at the start of procedure
        i. NO reversal available
    d. Xylazine 20mg/mL – 0.05-0.1mg/kg IV ONCE fetus(es) is/are delivered
        i. Reversal
            1. Tolazolene – only compounded currently
            2. Atipamezole – 0.1mg/kg SQ
                a. May be cost prohibitive

9. Goat protocol – IV catheter, LS epidural, clip and prep surgical site and administer local anesthetic, administer 0.2mg/kg midazolam/diazepam to “tie down” goat, prep the goat, prep yourself, administer epinephrine, administer additional midazolam if needed, cut the goat
10. Sheep protocol – LS epidural, clip and prep surgical site and administer local anesthetic, depending on the sheep 0.3mg/kg of midazolam may be enough to “tie down” the sheep, prep the sheep, prep yourself, administer epinephrine, administer additional midazolam and ketamine, cut the sheep
11. Scrub you and your team
12. Epinephrine – 1ml/100 lb IM or IV right before skin incision
13. Midazolam – 0.2mg/kg IV right before skin incision depending on how sedate from initial administration
14. Cut → Skin, cutaneous trunci muscle, external abdominal oblique, internal abdominal oblique, transversus abdominus, and peritoneum
    a. **Caution should be taken when incising the muscle layers because they can be incised very quickly and you have entered the abdomen
    b. The rumen is closely associated to the peritoneum and if accidental incision occurs, pack abdomen, and suture it using an inverting pattern
15. Put on an ob sleeve and push rumen cranial
16. Carefully grasp the gravid uterine horn and bring to the incision. The abdomen can be packed, but the author does not routinely do this.
17. Incise the greater curvature of the uterus such that the fetus can be removed without tearing the uterus and have the neonatal receiving team ready

18. Check for another fetus (“spares”) and attempt to remove it through the same incision. If this doesn’t occur make another incision such that iatrogenic tears don’t occur.
19. Check for tears and repair those once the fetus(es) is removed
    a. This is easier said than done and sometimes there can be excessive hemorrhage that is hard to control. The author has spoken with veterinarians who have spayed these animal using a zip tie and controlling the hemorrhage. Others have performed a “routine” spay. Tears that are located in the cervical region or uterine body can be difficult to fully repair and hemorrhage may be impossible to control. Blood transfusion, 20-40mL/kg, may be necessary in these cases.
20. Close the uterus in a Utrecht pattern utilizing monocryl or PDS (2-0 – 0). Catgut has been utilized for many years; however the author has gone away from its use. Some practitioners utilize a double layer closure and that is left to the comfort of the veterinarian and contamination of the uterus.
21. Check for tears again once the uterus is closed and repair them quickly
22. Lavage the abdomen with saline and begin closure
23. Closure of the abdomen is most commonly done in a 3-4 layer closure
24. The muscle fascia is grasped and is closed in a simple continuous patter using vicryl or PDS (0 or 1)
25. Normally, the author grasps the transversus and internal abdominal oblique and closes this layer, then the external abdominal oblique and closes this layer in a simple continue pattern
26. The skin is closed in a ford interlocking with two interrupted sutures at the ventral portion of the incision utilizing 1-0 nylon

27. Aerosol bandage spray applied

If the owner is only concerned about the fetus(es) and the practitioner deems a c-section necessary, a terminal procedure can be performed exactly as described above. The intent would be to euthanize the dam immediately after the birth. Some may choose to perform this after euthanasia of the dam, but caution should be taken, especially if you are not quick, because fetal death will occur quickly.

Fetotomy is another option and should only be utilized if the fetus(es) is deemed deceased. Subcutaneous fetotomy over a percutaneous approach is recommended.[5,12] The approach has been described and is safer for the dam.[5,12] If the fetus is emphysematous or dead with the head and neck extended, decapitation and neck amputation is a feasible option. If cost prohibitive, long duration of labor, dead fetus, or severe obtundation, euthanasia is a valid treatment option.

Post-operative care of the dam

Patient status, electrolyte, and metabolic disorders should be corrected if these weren't addressed before or during the procedure. Every case and thus treatment of these disorders will be different. If excessive hemorrhage occurred and there is need for a blood transfusion, 20-40mL/kg is recommended for administration.

Currently there are no drugs (antibiotics or anti-inflammatories) approved for surgical procedures in small ruminants. Small ruminants are still considered a minor species in the eyes of the Food and Drug Administration (FDA), but this does not mean that one should go rogue with drug use. It is important to remember these animals just had a major abdominal surgery and pain control is imperative. Flunixin meglumine, 1.1mg/kg intravenously, can be administered every 12 hours for three consecutive days if necessary. This can be tapered to once daily if pain

seems under control based on physical examination. Owner preference may be to treat the animal at home and meloxicam, 0.5-1mg/kg orally once daily, can be used. Opioid administration is often necessary for pain control. Butorphanol, 0.4mg/kg intramuscularly every 3-4 hours or subcutaneously every 2-3 hours, can be administered for pain.[13] Morphine, 0.2-0.4mg/kg every 4-6 hours by, intravenous, intramuscular, or subcutaneous route is recommended.[14] If pain control is needed quickly after the procedure, 0.1-0.2mg/kg morphine intravenously can be utilized.

Antibiotic administration is variable and often clinician dependent and it is important to remember that just because we can doesn't mean we should. Currently FDA approved injectable drugs in sheep include the following: procaine penicillin G, oxytetracycline, ceftiofur sodium, and tilmicosin. The only approved injectable drug in goats is ceftiofur sodium. Approved use of these drugs is for respiratory disease caused by either *Mannheimia haemolytica* or/and *Pasteurella multocida*.

Commonly administered antimicrobials at this institution and by the author include the following and are considered extralabel and withdrawal times should be followed:

a. Ceftiofur sodium (50mg/mL): 2.2-5mg/kg IV, IM, SQ every 12-24 hours for 5-7 days
b. Florfenicol (300mg/mL): 20mg/kg IM and then repeat in 48 hours, 40mg/kg SQ can be repeated in 96 hours
c. Tulathromycin (100mg/mL): 2.5mg/kg SQ once, can be repeated in 5-7 days
d. Oxytetracycline (200mg/mL): 20mg/kg SQ once, can be repeated in 48-72 hours
e. Ceftiofur crystalline free acid (200mg/mL):6.6mg/kg SQ once The author doesn't use this drug because ceftiofur sodium is approved for use in sheep and goats (other indication).

Fetal membranes should pass within 12 hours after parturition. The author administers oxytocin, 5-10 international units IM, SQ, or IV. Administration continues every three hours until membranes have passed or until 24 hours later.[5] Facilitating expulsion of the fetal membranes will reduce complications such as metritis and endometritis.

Complications following c-section include retained fetal membranes, metritis, incisional site infection and dehiscence, uncontrolled metabolic issues, and ultimately death. These conditions can each be treated on their own or in combination with the other. Obviously, death is not treatable. Future breeding and fertility may be thought of as a complication, but as it stands there is no long term prospective study that has evaluated this. 84-100% of postsurgical cases achieved pregnancy in the next breeding season in one report.[5,15,16]

Post-operative care of the neonate

The other component and sometimes most important is the neonate. After removal from the uterus, the neonate should be stimulated to breath and ensure there is no hemorrhage from the umbilicus. Stimulating the nose by using the great vessel (GV) 26 point will often cause them to take a breath. Coupage of the thorax, suction of the mouth and nose, brief hanging will also remove excess fluid and stimulate breathing. Some drying of the neonate is acceptable but should be left to the dam such that mismothering is minimized. If the neonate is not dried all the way, monitoring the temperature is important because hypothermia occurs quickly especially in a cold environment.

Drug reversal may be considered in the neonate. Ability to reverse drugs will depend on drugs administered during the procedure and if an antagonist is available, as well as, the drug availability at that clinic. Commonly used reversal agents by this author include flumazenil,

0.02-0.05mg/kg IM to reverse the benzodiazepines; naloxone, 0.03mg/kg IM to reverse opioids, and atipamezole 0.1mg/kg IM to reverse xylazine. (Personal communication with Dr. HuiChu Lin) Compounded tolazoline is available in various concentrations and it should be dosed accordingly. Drug reversal is not benign and more does not equal better. Ruminants are sensitive to reversal agents and worst-case scenario with their use is death.

Timely administration of colostrum or a colostrum replacer is imperative. Disease prevention is also important and will depend on goals of producer. Lentivirus status should be established in well managed herds. Johne's disease and caseous lymphadenitis free herds are harder to establish especially if there is movement of animals and one time testing. Administration and amount of colostrum to provide to small ruminants has not been intensively studied as it has been in calves. Variability of timing and amount exists in the literature. Because these neonates are born agammaglobulinemic it is important to provide colostrum or ensure they are suckling soon after birth. Cattle studies support that colostrum administration should be within 6 hours of birth because the apparent efficacy of absorption begins to decline after 12 hours.

Small ruminant females can be administered oxytocin and milked after the completion of the surgical procedure. Colostrum should be tested using the Brix refractometer. There is evidence with cutoff points to support the Brix use.[17] This allows for colostrum to be used, frozen, or stored especially if the neonate or dam dies. If the dam does not appear to be interested in mothering the neonate, then providing maternal colostrum or a replacer is important. Recommended amounts are 5% at the first feeding and then an addition 5% within a 12-hour period.[18] Other recommendations include 10-20% of body weight within the 12-hour period. Vigorous neonates will attempt to latch and suckle very quickly after the surgical procedure. 20% of body weight equilibrates to 50ml/kg (1oz/lb) of body weight.[3] Veterinarians and owners

alike should be confident in tube feeding the neonate to ensure adequate intake, especially if they are unwilling to suckle. The author prefers to use a 12–16-gauge red rubber catheter depending on size of neonate.

Dipping of the umbilicus is still up for debate and variable among farms and clinicians.

Finally, through learning and listening the rules of the neonate apply to all ruminants and should be followed immediately after the surgical procedure and within the first weeks to month of life.

Rules of the Neonate

1. Eyes
    a. Cloudy → indicating hypopyon or cataracts
    b. Normal reddening at the scleral/limbic junction after birth
    c. Other abnormalities noted
2. Joints
    a. Palpate every joint
        i. Non-painful, non-effusive is normal; small amount of joint fluid can be palpated in the normal neonate
        ii. Don’t forget elbows and stifles – they will sneak up on you
    b. Aseptic sampling can be performed
3. Umbilicus
    a. Size
    b. Firm versus soft
        i. The first days after birth the umbilicus should be soft and non-painful

        ii. Within the first month it will <0.5cm and should continue to be non-painful
    c. Drainage or odor
        i. Abnormal after the first 1-2 days
    d. Hernia present – Y/N
4. Rectum
    a. Is it present?
        i. Digital exam
        ii. Don't forget about the possibility of recto-vaginal fistula
            1. Likely more rare than the calf
    b. Feces/meconium passed
5. Palate
    a. Run you hand along the entire palate
        i. Midline from the dental pad and caudal
    b. The dam often will kick at or not let the neonate suckle because the suckle is incorrect
    c. Milk may come from nose

Conclusion

C-section is a common procedure that can be performed in the field with local and injectable anesthesia. Maintaining a sterile field is important to decrease the risk of peritonitis and incisional infection. Control of post-operative pain is imperative. Not all c-sections and neonates

die and most often they don’t require long term hospitalization. Care of the neonate is important to ensure adequate transfer of passive immunity.

Image 1: Lumbosacral Space – where the two lines intersect

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