

Small ruminants for cow guys and gals

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Sheep and goat ownership has been on the increase for several years and shows no signs of slowing down. Many practicing rural veterinarians are often comfortable with cattle, but may be less so with small ruminants. With a foundational knowledge of bovine anatomy, physiology and common disease processes, developing an expertise in small ruminants is possible after learning some key differences. Small ruminant medicine and surgery can be very rewarding and is an important potential growth area for many practices.

Key words: sheep, goats, herd health

Vaccinations and parasite control

The single core vaccination for all small ruminants is the “CDT” vaccination, or *Clostridium perfringens* types C & D with tetanus. There are a wide variety of commercial products available and, with rare exception, staying with a 3-way product is sufficient and I do not routinely recommend a cattle-labeled 7, 8 or 9-way vaccine unless it also has a small ruminant label. The lower valence vaccines tend to be less reactive in small ruminants and generally are a 2cc subcutaneous dose. There is evidence to show that goats may have a shorter duration of immunity to the epsilon toxin of *C. perfringens*, so while CDT is considered an annual vaccination after an initial vaccine and booster around weaning in sheep, it should be administered twice a year in at-risk goats. In adults, we generally time the dose at 4-6 weeks prior to the start of lambing and kidding to improve colostral immunity. In non-breeder herds, a convenient time of year is sufficient.

Rabies vaccine is something to consider in small ruminants. Most large animal products will have a sheep label, with safety and efficacy data. Use of these products in goats is extra label and therefore no safety or efficacy is implied. I have personally administered many doses of large animal-labeled rabies vaccine to goats without known negative effects, but owners should be educated to make a decision about using it in their goats.

Internal parasites are the number one threat to small ruminant production worldwide, and smaller operations tend to be hit most severely. Large herds tend to cull based on parasite susceptibility, while smaller herds and flocks tend to keep animals around despite their parasite burden. Most farms purchase their parasite problems by bringing in animals from unknown backgrounds, rescue situations or sale barns, and by not applying an appropriate quarantine treatment.

Hemonchus contortus is the most significant parasite of small ruminants, but there are others that are important co-infestors, including other trichostrongyles, *Nematodirus* and coccidia. *Hemonchus* is a highly prolific worm, with a female laying 5-10,000 eggs per day and thriving on pasture. Routine deworming on a set schedule must be abandoned on all small ruminant operations in favor of refugia-sparing strategies. These include selective treatment of only animals who need treatment and culling of animals who repeatedly turn up to have a significant parasite burden. Quantitative fecal examinations (McMaster’s or Mini-FLOTAC) and the use of FAMACHA scoring facilitate identifying animals that are the source of high egg shedding – who needs to be treated and who needs to be culled. FAMACHA scoring is useful for detecting anemia in *Hemonchus*-infected animals, but does not detect protein loss due to other parasites, making routine fecal examination critical. Many small landholders have inadequate acreage to rotate pastures, leading to a heavy larval burden on the land. Herds must be encouraged to get numbers down to be able to rotate or to access more land. The fecundity of sheep and goats results in overstocking very rapidly, particularly when owners are reticent to sell off babies.

Many herds experiencing issues with parasites also have inadequate protein and trace mineral nutrition which are worth investigating. All animals should have a loose trace mineral supplement labeled for the species available at all times.

Table 1: List of approval status for common antimicrobials for sheep and goats.

Drug	Sheep	Goats
Ceftiofur sodium	Labeled for respiratory disease	Labeled for respiratory disease
Ceftiofur HCL	Not approved	Not approved
Ceftiofur CFA	Not approved	Not approved
Penicillin procaine	MUMS approved	Not approved
Oxytetracycline	MUMS approved	Not approved
Florfenicol	Not approved	Not approved
Tulathromycin	Not approved	Not approved
Tilmicosin	Labeled for respiratory disease	Not approved - FATAL
Enrofloxacin	ILLEGAL	ILLEGAL

This chart serves only as a convenient starting point. Always check labels and regulatory guidance for most up-to-date information. For minor use/minor species (MUMS) information, visit http://www.farad.org/vetgram/min_species.html.

When deworming is indicated, I recommend using the drug dosing charts available by species at wormx.info → Topics → Deworming → Charts.

Finally, all herds and flocks should be evaluating nonpharmacologic methods of parasite control to increase the sustainability and efficacy of the available anthelmintics. Copper oxide wire particles (boluses), nematode-trapping fungi (BioWorma) and Lespedeza have all been shown to be effective at reducing parasite shedding and burden on the pasture. They are not dewormers and do not treat for parasites, but can lessen the need for deworming. Multiple studies evaluating diatomaceous earth have shown it to have no impact on controlling parasites or burden.

Appropriate drug use

Most drug use in small ruminants is extralabel. In the U.S., only one antimicrobial is labeled for sheep and goats for respiratory disease (ceftiofur sodium), one for sheep (tilmicosin) and a handful of dewormers are labeled for sheep and/or goats. Extralabel drug use in small ruminants falls under ELDU and AM-DUCA requirements, which include a valid VCPR, a preliminary diagnosis and provision and execution of an extended withdrawal. When used in an extralabel fashion, the residue tolerance in edible tissues will be zero, which almost always means a longer withdrawal than the label states will be required. FARAD is an excellent source of information on extended withdrawals and FARAD has produced a convenient paper that provides withdrawals for most drugs used extralabel in small ruminants.¹ This paper discusses medicated feeds, amprolium, ceftiofur, fenbendazole, florfenicol, flunixin, meloxicam, oxytetracycline, penicillin, tulathromycin, and intramammary preparations, among other drugs.

There are a few class or drug-specific rules that should be remembered with regard to small ruminants:

- Minor species are exempt from the extralabel use of cephalosporins rule.
- Tilmicosin is labeled for use in sheep but is fatal in goats.
- Fluoroquinolone use in sheep and goats is illegal for any disease.
- Procaine penicillin should not be used by the subcutaneous route due to inconsistent absorption and an inability to provide an accurate withdrawal.
- Extralabel drug use in feeds of small ruminants is illegal, however CPG 615.115 states:

“...However, when there are no approved treatment options available and the health of animals is threatened, and suffering or death would result from failure to treat the affected animals, extralabel use of medicated feed may be considered for treatment of minor species. Because of the need to have therapeutic options available for treatment of minor species, and to help ensure animal safety and human food safety, FDA is issuing this revised CPG to provide guidance to FDA staff with respect to factors to consider when determining whether to take enforcement action against a veterinarian, animal producer, feed manufacturer, and/or feed distributor for the extralabel use of OTC and VFD medicated feeds in minor species. In general, the Agency will not recommend or initiate enforcement action against the veterinarian, animal producer, feed mill, or other distributor when extralabel use is consistent with this document...”

Sedation, systemic and local anesthesia and analgesia

Small ruminants are generally safely sedated and anesthetized using drugs commonly used in cattle. One exception is xylazine use in sheep, which can be successful, but occasionally causes a fatal pulmonary edema.² In cattle, xylazine has been shown to reduce uterine blood flow and oxygen delivery to fetuses, so I tend to avoid xylazine in situations of a live fetus for dystocias and C-sections.³

For these reasons, this first protocol is my preference for sheep and in situations of live fetuses. I use these drugs combined intramuscularly.

- 0.05mg/lb (0.1 mg/kg) butorphanol
- 0.1mg/lb (0.2 mg/kg) midazolam
- 1-3mg/lb (2-4 mg/kg) ketamine

This protocol uses xylazine and I use these drugs together combined intramuscularly.

- 0.05mg/lb (0.1 mg/kg) butorphanol
- 0.05mg/lb (0.1 mg/kg) xylazine
- 1-3mg/lb (2-4 mg/kg) ketamine

Regarding the ketamine ranges in these protocols, 1-2mg/kg of ketamine is nice for standing or light sedation, while the higher end of the range can produce more profound sedation, up to near the level of general anesthesia. I always like to keep 1mg/kg of ketamine drawn up and available during any sedated or anesthetized procedure as it can be safely given intravenously during the procedure should the animal attempt to wake up. A modification to these protocols can also be the substitution of morphine for butorphanol at the same doses. Morphine saves on cost and is very effective in ruminants for pain. We do not see the GI stasis/constipation side effects of opioids in ruminants as we do in pigs or other monogastrics.

Local anesthesia should always be considered as an adjunct for sedation or anesthesia for painful procedures. Sheep and goats are more sensitive to lidocaine than cattle and I observe a toxic dose of lidocaine of 2.3mg/lb (5mg/kg) in sheep and goats. The dose can always be q.s. to a desirable volume with saline when the block will be anatomically extensive. For disbudding or dehorning in goats, both the zygomaticotemporal and infratrochlear nerves must be blocked, as shown Figure 1.

I recommend following up with a NSAID in dehorned animals, which I will discuss below.

The lumbosacral (LS) epidural is a useful block, especially in small ruminants where their ambulation can be controlled until the block wears off. LS epidurals provide motor and sensory blockade up to the level of the umbilicus, making it ideal for hindlimb disease or surgery, C-sections, urolithiasis procedures and the caudal portion of an umbilical hernia repair. LS epidurals must be provided aseptically, with a clip, rough prep and sterile scrub. The LS space is readily identified just caudal to a horizontal plane across the ileal wings (Figure 2). It can be opened widely by bringing the hindlimbs forward, as shown below. The dosage of 2% lidocaine for LS epidural is 1mL/15# (7kg) of body weight. It is possible to inadvertently perform a CSF tap at this site. If fluid begins to exit the needle during insertion, simply halve the total dose of lidocaine.

Figure 1: For disbudding or dehorning in goats, both the zygomaticotemporal and infratrochlear nerves must be blocked.



Figure 2: The LS space is readily identified just caudal to a horizontal plane across the ileal wings.



Small ruminants benefit from effective analgesia and a multi-modal approach. The drugs I have used most often to control pain in small ruminants are:

- Flunixin 0.5-1mg/lb (1.1-2.2 mg/kg) SID-BID – usually given IV at the time of a procedure, then follow up with meloxicam at home.
- Meloxicam 1mg/lb (2mg/kg) then 0.5mg/lb (1mg/kg) SID - EOD – can be provided in an oral drench or in feed at home.
- Morphine 0.02-0.05mg/lb (0.05 - 0.1mg/kg) SC q 4-6-8 hours – I most often use opioids while animals are in the hospital with orthopedic pain.
- Gabapentin 4.5-7mg/lb (10-15mg/kg) PO BID – I do not use gabapentin in small ruminants as often as in cattle, but it can be very helpful in cases of chronic pain in conjunction with a NSAID and other therapies.

Reproduction

Unless you are involved with advanced reproductive techniques, the three most common reproductive issues you will be asked to treat are dystocia, situations where owners want an animal aborted or induced, and spontaneous abortions.

In general, I strongly discourage induction of parturition in sheep and goats due to the fact that it nearly always results in non-viable lambs and kids. They can only be taken about five days early and there is variability in gestation length between animals. Induced lambs and kids do not do as well as some induced calves can. The most common reason to consider induction is in does and ewes with pregnancy toxemia. Goats are CL-dependent throughout pregnancy; therefore, dexamethasone alone will not terminate the pregnancy. That said, we do typically use dexamethasone with induction in an attempt to better prepare the kids. The dosing for induction in goats is: dinoprost 5-10mg or cloprostenol 100ug/45kg plus dexamethasone 10-15mg, given separately intramuscularly. For sheep, maintenance of pregnancy is more like that in cattle with CL early on, then placenta takeover about one-third of the way through. Dexamethasone will abort sheep in the placental phase, but providing a prostaglandin at the same time will tighten the window to parturition (to about 12-24 hours), so we generally use the same protocol as for goats. Sheep are more like cattle – move from CL to placenta.

Regarding dystocia, it is important to recognize that the vaginal and uterine walls are extremely thin compared to cattle. For this reason, transvaginal manipulation of fetuses should be done very gently. I generally recommend setting a timer and, if significant progress is not made in 30 minutes of manipulation, a C-section should be performed. Veterinarians should remember that small ruminants may carry a number of serious zoonotic pathogens, even during normal-appearing pregnancies and deliveries. The use of PPE is critical to client, staff and personal safety. Common pathogens of the reproductive tract in small ruminants include *Coxiella* (Q fever), *Chlamydia*, *Leptospira*, *Listeria*, *Brucella* and Cache Valley Virus.

Top five multi-species farm issues

Most small ruminant owners are small landholders who have multiple livestock and non-livestock species on their farm. Veterinarians must recognize the interaction in these species that may result in disease. This is a non-exhaustive list of these potential interactions, but serves to represent the five that I consider to be the most common and critical.

Sheep, and less so goats, are exquisitely sensitive to dietary copper and copper from other sources, such as footbaths and supplements. Horses, cattle, swine and poultry all have higher dietary copper requirements and therefore, their feed and mineral preparations are generally toxic to sheep. Copper toxicity carries a poor prognosis without significant intervention, and clients should be encouraged to find ways to secure risky feeds away from small ruminants and to feed species separately.

Ionophores are included in ruminant feeds to control coccidia and promote growth. Horses and camelids, however, are highly sensitive to the cardiotoxic effects of monensin, with very low dose thresholds for toxicity. Monensin and other ionophore toxicity is highly fatal and owners should be encouraged to secure ionophore-containing feeds away from sensitive species or to use other coccidiostat feed additives (such as decoquinate) where at-risk species reside.

Grains, specifically corn, are available at different grinds for different species. For example, for some poultry and swine feeds, it is ground to nearly a powder, while for cattle, it may be left whole or cracked. The more process that is placed on corn, the more rapidly fermentable carbohydrate is available from it. So, while swine and poultry can handle highly processed corn, a ruminant who gets into a large amount of this corn will likely experience a potentially fatal rumen acidosis. This is an important educational point for owners who may think that corn is corn.

Alfalfa is an important source of fiber and protein for many species. It is, however, high in calcium and may be associated with the development of calcium carbonate and other calcium-containing uroliths in goats, particularly miniature African breeds.

Avermectin-class dewormers are widely used in nearly every species, small and large. White-footed herding breeds of dogs are sensitive to neurological disease caused by avermectins and can become exposed when dewormers fall out of the mouth of the target animal or are excreted in the feces of treated animals. These drugs should be used with caution in farms where sensitive breeds are exposed to livestock.

Recommendations

I have some general recommendations when working for small farms with small ruminants. First, make farm visits whenever possible. Most health problems stem from husbandry shortfalls, and it is impossible to get a really good idea of how animals are managed when they are being brought into your clinic. Next, charge by the hour. Not only will you be investigating how the animals are managed, but you will likely spend considerable time educating the client in proper care. A flat exam or farm visit fee will often be inadequate. Small landholders are strongly drawn to internet information. A “stay off the internet” approach will not work. A better and more effective strategy I have found is to provide them with sites, publications or books where I have found accurate information. Take every opportunity to teach and provide handouts and written protocols so that they have something to reference when you’re not around or available. Finally, given that most small farms do not have a typical production calendar to guide vaccination and parasite monitoring timing, I have found that the small animal vaccine reminder approach to be very helpful in keeping these herd health tasks on track.

References

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