

Tales from the grave – Improving the job we do with on-farm sheep and goat postmortems

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Abstract

A distance-support program for assisting veterinarians to perform better on-farm postmortems on adult sheep and goats is presented. The support materials are explained – most of which are web-based, improving access and simplicity. Preliminary results indicate that many diagnoses have been made that may otherwise have gone undiagnosed, thus the results are a support to producers and their veterinarians in improving and fine-tuning flock/herd health programs.

Key words: small ruminant, sheep, goats, necropsy, post-mortem exam

Résumé

Un programme de soutien à distance pour aider les vétérinaires à faire de meilleurs examens post-mortem à la ferme chez des moutons et des chèvres adultes est présenté. Le matériel de soutien est expliqué et est disponible en grande partie sur l'internet améliorant l'accès et la simplicité. Les résultats préliminaires suggèrent qu'il est possible de faire un diagnostic dans des situations qui n'auraient pas été autrement bien diagnostiquées. Ces résultats peuvent donc assister les producteurs et les vétérinaires en améliorant et en ajustant les programmes de santé du troupeau.

Introduction

Surveillance of diseases of adult small ruminants has been poor over the years, and this affects our ability to both help our clients monitor the diseases of importance in their herds, as well as assist policy makers in deciding the importance of specific production-limiting diseases. It is estimated that 20 to 25% of the adult population of sheep and goats turn over in a herd annually. A proportion of those are deaths, estimated at around 5% and of the culls, a proportion (25 to 50%) are due to effects of disease rather than poor productivity. Very few of these animals are submitted to an animal diagnostic laboratory or receive a postmortem by a veterinar-

ian on-farm. Unlike other livestock sectors, small ruminants dying on-farm are not removed by dead-stock companies and are rarely necropsied due to low individual animal worth. This increases the difficulty of determining the important causes of adult mortality, which is a significant impediment to the improvement of the health of those industries, as well as the relationship between producers and their veterinarians.

This relationship between a veterinarian and the small ruminant client needs to be more directed to health management services rather than treating individual sick animals; often the emergency visit is not of value to the business-minded producer or the animals. We may be seen as a fancy cost and not one that can help with the overall health of the flock/herd, so we need to focus more on providing services that benefit the population rather than the individual. One of those services could be improved disease surveillance. This includes postmortems of unexpected or unexplained adult mortalities performed on-farm, including animals that are ill enough to require euthanasia. Most clients will balk at submitting a carcass to a provincial or state diagnostic lab because of the cost and time investment to transport a dead animal to a lab. Veterinarians performing these postmortems on-farm often do not obtain a suitable history, and may not record findings and take the right samples for further diagnostics. Our project, which will conclude at the end of 2018, was to develop a distance-support system for veterinarians performing on-farm postmortems.

Objectives

The intent of the project is to improve disease surveillance of infectious, emerging, zoonotic and other production-limiting diseases of adult sheep and goats on Ontario sheep and goat farms. A mechanism of distance support for this must be developed that allows veterinarians to upload the correct information and submit the correct samples to the Animal Health Laboratory, University of Guelph. Improved level of diagnosis will help producers and veterinarians create sound flock/herd health and biosecurity plans.

Materials and Methods

Only postmortems will be acceptable from adult sheep and goats greater than 1 year of age. The clients should be commercial farms and the animals should not be considered pets. Only veterinarians licensed to practice in Ontario and farms residing in Ontario are eligible. The project has money to compensate veterinarians for the time spent performing the postmortem on-farm limited to \$175. The value of the diagnostic tests performed on each case is \$400. The submission kits are also provided (a value of \$40 to \$50 per kit). The results are part of the Animal Health Laboratory database and are linked to the client and veterinary practice, as are all cases submitted to the AHL outside of the project.

Website

A password-protected website was developed to provide instructions to veterinarians on how to perform a postmortem. The site is compatible with all browsers and smart phones. Veterinarians who register with the project (limited to licensed veterinarians in Ontario), are given their own username and password and can access all the materials on the site. Before they begin, they are given a short list of requirements for the postmortem (Figure 1).

The list of diseases that will be routinely checked for:

1. Dental/oral disease.
2. Enzootic nasal adenocarcinoma.
3. Scrapie (only if signed informed consent form accompanies the sample).
4. Neurological disease (e.g. poliоencephalitis, listeriosis).
5. Maedi visna/caprine arthritis encephalitis.
6. Ovine pulmonary adenocarcinoma (Jaagsiekte).
7. Lung diseases (pneumonia – bacterial, viral, parasitic).
8. Rumen disease (grain overload, bloat).
9. Gastrointestinal nematode parasitism (e.g. haemonchosis).
10. Liver parasites (fluke, cysticercosis).
11. Paratuberculosis (Johne's disease).
12. Copper toxicity in sheep (tissue mineral panel).
13. Nutritional deficiencies (e.g. selenium).

14. Clostridial/bacterial enteritis.
15. Urolithiasis (males).
16. Mastitis.
17. Metritis.
18. If antemortem serum is available:
 - Beta hydroxybutyrate (pregnancy toxemia);
 - Hypocalcaemia in periparturient females.

If another disease is suspected, then the veterinarian needs to specify and provide appropriate photographs and samples. Examples of this are abomasal content (gastrointestinal parasites), urinary calculi, feces, sterile swabs of abscesses suspected to be caseous lymphadenitis, and rumen content if monensin toxicity is suspected.

Dr. Spinato created a video giving a detailed and careful demonstration of how to perform a routine postmortem on an adult small ruminant. It can be viewed at <https://www.youtube.com/watch?v=FYUiaTsDTDA&feature=youtu.be>.

Each registered veterinarian receives a project sampling kit: a cooler with the materials and instructions on how to perform a postmortem (Figure 2).

The instructions required a standard set of fresh and formalin-fixed tissues. Dr. Spinato created laminated sheets with photographs of the various tissues. The pictures are the correct size for the samples. The intent is that the veterinarian lay the samples onto the laminated sheet as they are performing the postmortem. An example is provided in Figure 3. After it is complete, they can put the tissues into the bags provided.

Very detailed written instructions are provided in how to perform the postmortem, and they include the requirement of digital photographs for baseline information. Examples of each photograph are provided to make sure the veterinarian has full understanding of the requirements. More photographs can be uploaded but this is the minimum number and type.

- Entire body in situ
- Thoracic cavity with viscera intact
- Abdominal cavity with viscera intact
- Ileocecal junction
- Pluck (heart and lungs)
- Abomasum opened with contents present, but moved so that abomasal wall can also be viewed.

The routine laboratory tests that are run on the provided samples are:

Figure 1. Requirements for getting started.

Samples submitted from autolyzed cases will be discarded and the case will be not accepted. Only submit samples from fresh carcasses.

The following information must be uploaded in order to process the case:

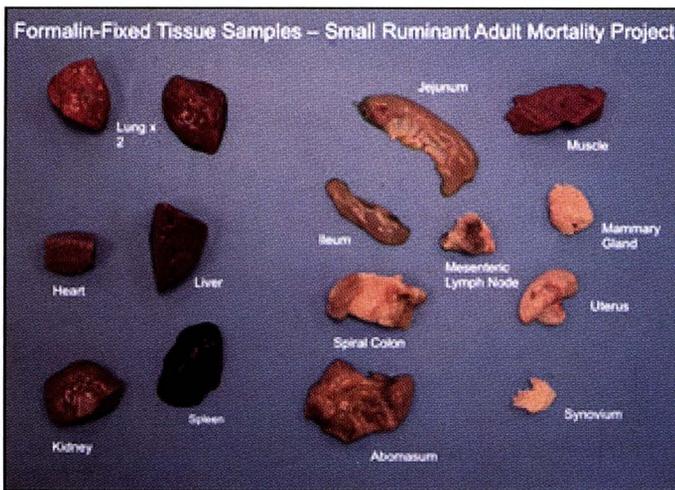
- Veterinarian and clinic information will be auto-populated from the Project Username (PU) information provided when first requesting an account. The PU is specific to each veterinarian, not the clinic.
- Owner information includes name, farm location and contact information. Provincial Premises Registry ID (PPR ID) is mandatory. The farm PPR ID can be applied for at the time of the farm visit.
- A description of the farm where the animal is located, as well as information about the livestock affected and at risk from this problem.
- Detailed information about this particular animal including relevant history, management, clinical signs and treatment.
- Postmortem findings based upon the project protocols. This will include required digital photographs.
- Your working hypotheses or diagnosis of the cause of morbidity/mortality of this animal.

Figure 2. Sampling kit.**Project sampling kit:****Provided:**

- 1 L screw-tip plastic container with 500 mL formalin
- Whirl-pak bags for samples
- 2 – 50 mL screw top tubes
- 1 – 30 mL screw top tube
- 2 – culture swabs
- Plastic bag for head
- Ice packs
- Styrofoam shipping box
- Disposable scalpel
- Forms (submission, scrapie permission)
- Return courier label

Not provided:

- PM knife
- Rib cutters
- Scissors, forceps

**Figure 3.**

1. Optional: obex will be sampled and submitted for scrapie ELISA screening ONLY if signed scrapie consent form is received.
2. Formalin-fixed tissues will be processed as per typical day case submission.
3. Fresh tissue samples:
 - A) Routine on every submission:
 - Bacterial culture – jejunum for *Clostridium perfringens*; genotyping analysis
 - Parasitology – fecal flotation
 - Toxicology – liver for tissue mineral panel analysis (copper toxicity, mineral deficiencies)
 - B) Optional tests if 1 or more of these specific disease conditions is suspected:
 - Bacterial culture – lung (pneumonia), mammary gland (mastitis), spleen (septicaemia), abscess swab (CLA), etc.
 - PCR for Johne's – ileum, spiral colon, mesenteric lymph node
 - *Mycoplasma* culture – lung (pneumonia)
 - IHC – *Listeria*, CAE, MVV

The on-line submission form has many required fields and cannot be submitted unless all of those fields are filled out. For veterinarians that do not have access to a smart phone or access to the internet on the farm, this information can be recorded in a paper form to be uploaded back at the clinic. We believe it is important to capture the information on the case at the farm while the client is likely present and not to rely on memory. This form facilitates that with drop-down menus to make data entry easier. Of great importance is the requirement for the Ontario provincial premises registry ID where the animals are located. No postmortem case will be processed without one – a requirement of the provincial funding body for the project. This will enhance the province's ability to perform geographically accurate disease surveillance. Beyond the normal signalment, information is required on the type of farm system (production type, size), and animals on the farm. It requires information on the number of animal affected (sick and dying), number at risk, and duration of problem in the herd. The animal that is the subject of the postmortem requires more detailed information. Beyond age, sex and breed and information on its illness, the form requires how the animal was managed, its nutrition, vaccination or other treatments. The veterinarian must provide a working clinical diagnosis on that animal, as well as diagnoses reached on other cases recently.

The postmortem findings require an assessment of body condition score, hydration status, fat stores in the carcass, and muscle mass. There are unlimited text areas to capture findings on the external exam, thoracic cavity, abdominal cavity, and pelvic tissues. Finally, the veterinarian is required to provide at least 1 diagnostic hypothesis for the cause of morbidity/mortality based on their postmortem findings.

The case is saved as a draft on the farm and can be uploaded once back at the clinic after the veterinarian has an opportunity to review what they have written. Once the case is submitted, the form cannot be edited but notes can be added if additional information comes to light subsequently (e.g. a missed treatment). Finally, because we are using project money to pay for the veterinarian's time to perform the postmortem, the veterinarian must invoice the project – this can be done online.

The project has funds to support 180 postmortems. It is expected that this distance-support system will result in an improved rate of diagnosis, and improved knowledge transfer between veterinarians and producers with respect to the health management cycle. By providing this opportunity, we hope to improve the value of the health management relationship between the producer and their veterinarian.

Results

The project is ongoing until December 31, 2018 and the focus groups of veterinarians and producers are still occurring. We will provide some preliminary results of what has been seen to date. The web page has met the needs of

the project and shows that having information and forms available online is helpful for veterinarians.

To date, 101 cases have been completed. Only 1 case has been submitted per flock/herd issue and most likely 1 per flock/herd. Table 1 has the diagnoses in goats to date (n=47) and Table 2 has the diagnoses in sheep to date (n=54).

Almost all of these diseases are important at the herd level. It was not a surprise that the top diagnosis was clostridium enterotoxaemia due to *Clostridium perfringens* type D. Our dairy goat herds struggle with losses from this disease, both from mortality but also severe morbidity which, if the animal recovers after treatment, may end the lactation. Proper vaccination programs help, but ration issues may be just as important including prevention of subacute ruminal acidosis that may be occurring on the pellet feeding programs common in this province. The industry should already have a good handle on eradication of CAE, yet it continues to be a major issue in adult goats. Listeriosis continues to occur in many of our herds, perhaps from improper bunk management or ensiling practices, but may also be from dirty feeding

Table 1. Summary of postmortem diagnoses in adult goats (n=47).

Diagnosis in goats	Number of cases
Clostridial enterotoxaemia	7
Caprine arthritis encephalitis (CAE)	6
Listerial encephalitis	5
Pneumonia	4
Endometritis	3
Copper toxicity	2
Idiopathic colitis	2
The following have 1 diagnosis each: megaesophagus, thymoma, chronic bloat, <i>Yersinia pseudotuberculosis</i> enteritis, Johne's disease, dental disease, clostridial malignant edema, pregnancy toxaemia, gastrointestinal parasitism, laminitis, septicemia, with 7 cases undiagnosed.	

Table 2. Summary of postmortem diagnoses in adult sheep (n=54).

Diagnosis in sheep	Number of cases
Copper toxicosis	6
Nasal adenocarcinoma	5
Endometritis	4
Caseous lymphadenitis	3
Dental disease	3
Gastrointestinal parasitism	3
Haemonchosis	3
Pneumonia	2
Pituitary adenoma	2
Polioencephalomalacia	2
The following have 1 diagnosis each: heart failure, ionophore toxicity, clostridial enteritis, bladder rupture, brain abscess, lameness, diarrhea, lymphocytic abomasitis/enteritis, nasal abscess, pregnancy toxaemia, septicemia, septic arthritis, rhinitis/sinusitis, ruminitis, urolithiasis/nephrolithiasis, chronic hepatitis, mammary abscess with 4 cases undiagnosed.	

conditions. It was a surprise that the project had 2 separate cases of copper toxicity. Usually sheep are identified as the most at-risk, but perhaps we need to educate goat producers more on the risks of copper added to feed. While we have not completed the focus group discussions with producers and veterinarians, the initial feeling is that information gained from the postmortem is valuable to improving the health of the remaining animals in the herd.

As with goats, almost all of the diagnoses are relevant to the health of the flock and not just the individual. It is disappointing that copper toxicosis is still such a common diagnosis. Without knowing the details of the cases about possible exposures, it is likely that these losses were a surprise to the producer and may represent contamination of feeds or pasture. It points out the need to continue to educate the feed industry and producers about the risk to sheep from copper.

The second most common diagnosis, enzootic nasal adenocarcinoma (ENA), is likely a surprise to producers but research at the University of Guelph suggests that this condition is very common and may have a high incidence rate in some flocks. These cases are unlikely to be diagnosed properly unless the head is split open to reveal the tumor. It is likely that many are incorrectly diagnosed as pneumonia by the producer. It is caused by a betaretrovirus that is infectious and shed in nasal secretions. It is time to do more education on this disease and perhaps offer a nasal PCR test developed at the University of Guelph to assist with eradication.

Gastrointestinal parasites, and in particular haemonchosis, continue to be a problem in Ontario lambs, but these are adult animals where we should expect better immunity. Losses in adults likely indicate that more education and outreach is necessary to producers so that they have the tools to better manage these parasites.

Conclusions

We have provided long-distance support for veterinarians to offer a valuable service to their small ruminant clients. Understanding why adult sheep and goats die or need to be euthanized, when the reason is not apparent or when it is unexpected, can prevent losses in the rest of the flock. This will also help monitor flock health programs to make sure that goals for health are being reached. We are assessing the value that producers and veterinarians place on this support and also what other services would be valuable to the health of the flock/herd. It is our plan to continue to support veterinarians with helpful information after the project has ended.

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