



10. Neurological Diseases

A wide variety of diseases can affect the nervous system of small ruminants. Most present as any one or a combination of:

- Depression
- Inability to get up
- Difficulty in walking

Making a diagnosis is challenging. This section covers the most common diseases, and the goal is to enable you to narrow down the possible causes of the clinical signs you are presented with, by taking into account both the clinical signs and factors such as the age and production stage of the animal. It is important to recognize that no single disease is ever described by only one clinical sign. For example, not all staggering sheep have scrapie, but scrapie is on the list.

Diseases typified by circling:

- Listeriosis
- Tapeworm Cysts (GID)

Diseases typified by staggering gait:

- Scrapie
- Tetanus
- Brain Worm (Cerebrospinal Nematodiasis)
- Caprine Arthritis and Encephalitis (CAE)
- Maedi-Visna (MVV)

Diseases typified by blindness:

- Polioencephalomalacia

Diseases typified by abnormal behaviour:

- Rabies

Listeriosis

Cause

The bacterium, *Listeria monocytogene*, is naturally found in the soil. If silage is made with contaminated soil and the pH does not fall low enough *Listeria* can easily grow in the silage. Animals that eat this silage are at risk of disease. *Listeria* can cause abortion (refer to *Chapter 6, Listeriosis*) or the bacteria may penetrate down the side of a tooth where they can enter nerves and ascend to the brain where they cause disease.

Clinical Signs

As listeriosis is a bacterial infection most affected animals run a mild fever. Since the bacterium initially affects only one side of the brain, the signs are asymmetrical. Often one side of the face is paralyzed and the animal is unable to eat; the ear on the same side is often dropped, and close examination of the eyes may reveal that they flick from side to side. Many affected animals will also walk in a circle.

Diagnosis

It is possible to collect a sample of fluid from the spine to confirm this diagnosis, but most often affected animals are treated on the basis of clinical signs.

Treatment

Listeria bacteria can be treated with antibiotics. Common strategies include penicillin at the label dose, but twice daily, or oxytetracycline at the label dose, but twice daily. (These are both ELDU protocols and require a veterinary prescription.) Treatment should be continued for approximately 10 days. Since many affected animals cannot drink they will often require fluid therapy through a stomach tube.

Prevention

Use only good quality feed. Never feed spoiled silage. Old silage left in the feed yard that is not cleaned up can be a risk. Very occasionally cases of listeriosis occur in animals with no access to silage.

ELDU

Extra-label drug use, also referred to as "off-label use" refers to the actual use or intended use of any drug, whether it is a prescription drug or over-the-counter (OTC) drug, in an animal in a manner that is not in accordance with the approved label or the package insert of the drug licensed by Health Canada.

Tapeworm Cysts (GID, Sturdy, *Taenia multiceps*, Coenurosis)

Cause

The tapeworm, *Taenia multiceps*, has a similar life cycle to *Taenia ovis*. (Refer to *Chapter 20, The Sheep or Goat as an Intermediate Host*.) The egg is passed by a dog in its feces and is eaten by the sheep/goat. The eggs hatch and the larvae move through the blood to the brain where they form cysts (*Coenurus cerebralis*). The cysts take approximately eight months to develop.

Clinical Signs

The presence of a large cyst in the brain can cause a wide variety of signs, mainly circling, abnormal walking and blindness.

Diagnosis

There may be softening of the bones of the skull over the cyst.

Treatment

It is possible to remove the cysts surgically, but this is not usually pursued. Most animals are humanely euthanized.

Prevention

Same as *Taenia ovis*, refer to *Chapter 20, The Sheep or Goat as an Intermediate Host*.

Scrapie

Cause

Scrapie is a degenerative condition of the nervous system affecting sheep and goats. The cause is an abnormal prion protein. A prion is not a living organism. It is not bacterial, viral, or protozoal, yet in small ruminants it is infectious. A normal brain contains normal prion protein. If abnormal protein enters the brain it may cause the normal protein to convert to the abnormal form. The abnormal proteins build up in brain cells and cause the cells to die. This brain damage leads to the observed clinical signs.

We know that sheep infected with scrapie excrete abnormal prion protein in the placenta and birth fluids. Infection of newborns and other females in the flock at this time is common and an important control point when you are dealing with the disease. The abnormal prion protein is ingested or crosses the placenta, and makes its way

to the brain. The time between infection and presentation of clinical signs is variable and can range from two to eight years.

Clinical Signs

The earliest signs of scrapie are mild changes in behaviour such as mild apprehension, fixed gaze, failure to herd and aggression. As the disease progresses the animal's condition will deteriorate; the gait becomes unsteady and clumsy, with animals often described as drunk looking. Some animals will develop itchiness. (Refer to *Chapter 8, Scrapie*.) Eventually, there may be tremors and a very strange goose stepping gait. In this debilitated state the animal may fall victim to another disease such as pregnancy toxemia, which is not related to scrapie, so if you do not look for scrapie in dead or euthanized adult female small ruminants you will not know if it is there.

Diagnosis

For many years the only diagnostic test for scrapie was to examine the brain after death. This is still the main test for the disease. It is possible for veterinarians to take a sample of tissue from the third eyelid which can be used to identify animals carrying the scrapie prion.

Treatment

There is no treatment. Scrapie is a fatal disease.

Prevention

Scrapie is a federally reportable disease. All **suspect** cases **must** be reported to the Canadian Food Inspection Agency (CFIA). Suspect animals are slaughtered and if they are found positive a protocol is in place to determine the susceptibility of other flock/herd members. Compensation is paid for animals culled due to scrapie. For more information on scrapie control programs refer to the Scrapie Canada (www.scrapiecanada.ca) and the CFIA websites (search CFIA scrapie and select *The Manual of Procedures*).

Scrapie Genetics

Scrapie is an infectious disease in which the animal's susceptibility is determined genetically. Scrapie belongs to a small group of diseases called transmissible encephalopathies (TSEs or prion diseases). All TSEs are characterized by a long incubation period, a relatively short clinical course, lack of host immune response yet no immune system suppression. There is considerable genetic variation in susceptibility

Current scrapie information:
<http://www.scrapiecanada.ca/genotyping.html>
and
<http://www.scrapiecanada.ca/certification.html>

to infection. For a complete description of scrapie genetics refer to Scrapie Canada (www.scrapiecanada.ca).

Tetanus

Refer to *Chapter 5, Tetanus*.

Brainworm (Cerebrospinal Nematodiasis)

Cause

The larvae of the worm *Parelaphostrongylus tenuis* (*P. tenuis*) cause this disease. This worm is normally carried by white tailed deer, where it rarely causes disease. Sheep and goats eat small slugs and snails which are carrying the larval form of the worm. The larvae are released in the intestines and make their way to the brain where they can cause serious inflammation, resulting in disease.

Clinical Signs

The most common sign is paralysis, which usually occurs in lambs/kids with bright attitudes and good appetite. Occasionally animals may appear blind or have a head tilt with severe depression.

Diagnosis

Your veterinarian may be able to collect a sample of spinal fluid for laboratory analysis to help with the diagnosis by looking for a cell called an eosinophil.

Treatment

Treatment with a large dose of ivermectin (an initial dose of 500 mg/kg subcutaneously – ELDU-requiring a prescription), followed by five daily doses of 200 mg/kg subcutaneously. Most animals should also be treated with anti-inflammatory drugs to suppress the inflammation caused by the death of the parasite.

Prevention

ELDU

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Minimize contact with white tail deer. Regular deworming will also help to prevent this disease in problem areas. If the small slug or snail that is the intermediate host for this parasite is in your area, then consider this disease as a possibility.

Caprine Arthritis and Encephalitis (CAE)

Cause

CAE virus is closely related to the maedi-visna virus of sheep. (Refer to *Chapter 12, Maedi-Visna.*)

Clinical Signs:

Kids are usually affected at one to four months of age. Kids appear drunk, and gradually become paralyzed in all limbs. Some animals may go blind. Most animals will die within two weeks.

Diagnosis

Blood test for CAE antibodies can help make the diagnosis.

Treatment

There is no treatment for this disease.

Prevention

Refer to *Chapter 12, Maedi-Visna.*

Maedi-Visna (MVV)

Cause

In some cases infection with the maedi-visna virus in sheep can result in neurological disease (the “visna” form). MVV is related to the caprine arthritis encephalitis virus of goats, with cross infection possible between the two species.

Clinical Signs

The earliest signs are a stumbling or drunken-like gait. The disease slowly progresses over weeks or months with the hind legs becoming completely paralyzed.

Diagnosis/Control

Refer to *Chapter 12, Maedi-Visna*.

Polioencephalomalacia (Polio, Thiamine Deficiency, Cerebro Cortical Necrosis, CCN)

Cause

The cause of this condition is a deficiency of thiamine (vitamin B1). Without thiamine the brain cannot process glucose (sugar) and the brain cells die of starvation. All ruminants have the capacity to produce their own thiamine requirements within the rumen; hence the disease can only occur when thiamine production in the animal is compromised.

This loss of production can occur in the following situations:

- Excessive carbohydrate in the diet causes rumen acidosis.
- Certain toxins such as bracken fern can cause polio.
- Some drugs, for example, Amprolium for coccidiosis can cause polio.
- Excessive sulphates, either in the water or feed, can interfere with thiamine production in the rumen.

Clinical Signs

The first signs of the disease are depression followed by apparent blindness. The animals may head press and become recumbent. Most often, early in the disease an animal just “looks off.” They often become rigid and extend the head back toward the shoulder. Animals then begin to convulse and will die. Polio becomes a very serious disease in the late-pregnant female when the likelihood of her developing concurrent pregnancy toxemia is greatest.

Diagnosis

The best diagnostic test for this is to assess eye function. In polio the animal goes blind and will not respond to sudden movement (it will not blink when an object moves towards it). Examine the animal in a dark area; if you shine a flashlight into the eye the pupil will get smaller. Animals that die of polio can be diagnosed through a post-mortem examination.

Treatment

These animals require thiamine. Injectable thiamine is available and animals should be treated at a dose of 10 mg/kg. The first dose should be intravenous (iv); subsequent doses of 10mg/kg every six hours for two days may be given intramuscularly (im). The sooner animals are treated the better chances for a positive outcome. Any treatment protocol for a small ruminant that is off feed for any reason should include thiamine. The use of thiamine does not constitute a food safety risk and withdrawal time is not an issue.

Prevention

Avoid sudden diet changes to diets rich in carbohydrates, and beware of sheep/goats eating bracken fern. Special care is needed when using Amprolium.

Note: Sulphate poisoning causes a similar condition to this. Refer to *Chapter 18, Sulphates*.

Zoonosis

– a disease of animals that may secondarily be transmitted to man.

Rabies

Zoonosis Alert: Humans are extremely susceptible to the rabies virus. Extreme care must be taken when handling rabies suspects.

Cause

The rabies virus may be carried by any warm-blooded animal and is considered endemic in the wildlife population; it is carried by skunks, rats, squirrels and other warm-blooded vermin. When any warm-blooded animal is infected, the rabies virus moves to the brain and affects the animal's behaviour. Rabies may be presented as either the "dumb" or "furious" form. The virus also spreads to the salivary glands and cerebrospinal fluid and is therefore present in the saliva and in the fluid surrounding the central nervous system.

Clinical Signs

Sheep and goats are essentially dead-end hosts for the rabies virus because they do not usually bite other animals. However, people who either handle infected animals or infected animal tissues during post-mortem examination can be at risk.

It may take weeks or months for the virus to reach the brain. However, once it reaches the brain and the animal becomes affected the animal typically dies within seven to 10 days. Signs of rabies are non-specific and include depression or excitation and aggression. Rams

are often noted to have sexual excitement. The disease progresses rapidly, with the animal often being paralyzed and salivating excessively.

Note: Do not examine the oral cavity of an animal salivating excessively without taking appropriate precautions. People die from rabies.

Diagnosis

The only way to diagnose rabies is by examination of the brain immediately after death. Since the brain tissues are required, care should be taken during performance of euthanasia, so that the brain is not damaged. Animals suffering from rabies look very much like those affected by scrapie and must be differentiated from them.

Treatment

Rabies is a fatal disease. There is no treatment for any species.

Prevention

Vaccines are available for use in sheep and goats. Rabies is a reportable disease and all suspect cases must be reported to the Canadian Food Inspection Agency (CFIA). Rabies is transmissible to humans. If you suspect rabies, never handle the animal without gloves. If you are exposed to body fluids from a suspect animal, notify your veterinarian who will notify the CFIA and the public health agency in your area to arrange for post exposure vaccination.



11. Diseases of Growing Animals

After the first few weeks of life, young animals are stronger and more resistant to disease but there are still several important diseases to consider, especially:

- Coccidiosis
- Pneumonia
- Enterotoxemia (Pulpy Kidney)
- Rectal Prolapse
- Urolithiasis

Coccidiosis

Cause

Coccidiosis is an infection of the intestines caused by the microscopic protozoal parasite *Eimeria* found in sheep and goats. Most types are harmless. However, several specific species can cause severe disease conditions. *E. crandallis*, *E. ovinoidalis* and *E. ahsata* can cause severe problems in lambs; *E. arloingi* and *E. ninakohlyakimovae* can cause severe disease in kids. The oocysts (eggs) are shed in the feces of adult animals or affected young lambs or kids. The oocysts require warmth and moisture to mature to the infective forms which are eaten by other young animals without immunity.

The parasite invades the cells lining the gut and completes its complex life cycle, destroying the cells. This can result in severe diarrhea, with the stool occasionally containing blood and/or mucus.

Clinical Signs

Animals between one and four months of age are most susceptible to infection. The disease most commonly presents as diarrhea, causing reduced growth rates and stunting. Sudden death from coccidiosis can occur with overwhelming disease, or death can result when a debilitated lamb or kid goes undiagnosed and succumbs to another disease.

Diagnosis

Diagnosing coccidiosis can be surprisingly difficult. It is possible to examine a fecal sample for oocysts; unfortunately, sheep and goats typically secrete many oocysts from species of *Eimeria* that do not cause disease. However, when you have clinical disease and evidence of *Eimeria*, assume that there is a correlation.

It is also important to recognize that in small ruminants, as in other species affected by coccidiosis, animals that are in the early or late stage of an *Eimeria* infection do not shed oocysts, but are still suffering from the disease.

Often the diagnosis is based on the clinical signs and knowledge of the management system. In severe cases, a post-mortem examination may demonstrate direct evidence of coccidiosis.

Treatment

There are many drugs that can help prevent coccidiosis (see below); however, most of these drugs do not help animals already showing clinical signs. The only drugs that can help at this stage are known as potentiated sulfonamides - for example, Borgal or Trivetin. These drugs are not licensed in these species and require a veterinary prescription.

Prevention

There are some simple management changes that can help to reduce the risk of coccidiosis in a goat/sheep herd. Increasing sanitation, avoiding overcrowding and using appropriate drugs are critical. Minimizing stress ensures that an animal's immune system is in the best shape to develop immunity and avoid disease.

Despite the best management practices, many producers must use medication to control the disease. These drugs are known as coccidiostats (see the following table).

There are no products in Canada licensed for use in sheep and goats. However, products are available for use in cattle and poultry.

These drugs are used in sheep and goats in Canada and other parts of the world; they are very safe to use. You will require a veterinary prescription to use them for your sheep or goats.

Coccidiostat options include:

Medication	Dosage Level	Regulated Use in Canada
Lasalocid	20 to 30 g/tonne of feed 0.5 to 1 mg/kg daily intake	Bovatec for cattle ELDU
Decoquinatate	100 g/tonne of feed 0.5 mg/kg daily intake for 28 days	Decox ELDU
Amprolium	50 mg/kg for 19 days (Note- this is five times the cattle dose)	Amprol solution for in water medication or feed mix ELDU
Monensin	10 to 30 g/tonne of feed	Coban - licensed in calves ELDU

Depending on the medication used, treatment options include mixing it with:

- Milk replacer
- Creep feed
- Ration
- Water
- Mineral mix

Care must be taken with dosage as overdoses can cause serious problems, especially with Amprolium, where excessive doses result in polio. Monensin toxicity results in death; some drugs are toxic to dogs and horses that may have opportunity to consume the medicated feeds.

Note: Monensin and Lasalocid also increase feed efficiency and increased growth rate.

Pneumonia

Refer to *Chapter 12, Respiratory Diseases*.

Enterotoxemia (Pulpy Kidney)

Refer to *Chapter 16, Clostridial Diseases, Enterotoxemia (Pulpy Kidney)*.

ELDU
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Rectal Prolapse

Cause

Rectal prolapses are most commonly associated with lambs having their tails docked too short.

Clinical Signs

Red inflamed bulging mucosa from the anus below the tail will be obvious. Lambs may be straining to pass feces.

Diagnosis

Observe the clinical signs.

Treatment

It is possible to carefully replace the rectum and stitch it in place but the problem has a tendency to reoccur. Most animals are humanely euthanized.

Control

Ensure tails are docked correctly. Do not purchase animals with short tails. See recommendations for tail docking in *Chapter 4, Lamb/Kid Processing*.

Urinary Calculi (Urolithiasis, Bladder Stones)

Refer to *Chapter 15, Urinary Calculi*.



12. Respiratory Diseases

Respiratory disorders (especially pneumonia) are common causes of disease in sheep and goats. Not all of them respond to antibiotics, so it is important to try and narrow down the potential causes of disease.

First, it is important to determine if the disease is affecting the upper airways or the lungs. Disease in the upper airway tends to be associated with noisy breathing (especially breathing in); there may also be sneezing and nasal discharge. Diseases affecting the lower airways tend to cause faster breathing and coughing, and may be associated with a fever.

Diseases of the Upper Airways

Laryngeal Chondritis

Cause

Damage to the vocal cords allows a bacterial infection to develop. Possible causes of damage include feeding dry grain, drenching injuries and genetic predisposition, especially in Texels and South Dorset breeds.

Clinical Signs

The disease comes on quickly, causing severe respiratory distress and collapse. Affected animals make very loud breathing sounds, especially when they breathe in.

Diagnosis

The signs are very characteristic.

Treatment

Some individuals can be saved with surgery but most are culled.

Control

Take care when administering oral medications.

Enzootic Nasal Tumour

Cause

The disease is caused by a retrovirus similar to that which causes pulmonary adenomatosis (*Jaagsiekte*). The virus is shed and spread through nasal secretions. The virus infects the cells in the nasal passage to create a tumour.

Clinical Signs

The disease is typically seen in middle aged sheep; there have been no reports of this disease in goats. There is nasal discharge and noise when breathing. In severe cases sheep may have difficulty breathing and may breathe through their mouths.

Diagnosis

A final diagnosis is often made at post-mortem. Careful examination of affected sheep may reveal an abnormal shape to the bones of the face.

Treatment

None. Affected animals should be humanely destroyed.

Control

Early culling of affected animals.

Nasal Miasis (Nose Bots)

Cause

Fly - *Oestrus ovis*. The adult female fly lays her eggs most commonly in the nasal openings of sheep. Goats are also infected, although less commonly than sheep. The eggs hatch and larvae crawl up the nose and develop high up in the nasal passages. They then emerge several weeks later and are sneezed out.

Clinical Signs

The presence of the fly agitates the animals, causing them to cluster together, stamp their feet and try to push their noses down to the soil in an attempt to avoid the flies. Once the animal is infected there is typically a large amount of nasal discharge. In severe cases

the larvae in the top of the nasal passage may form cysts, leading to pressure on the brain and severe neurological disease.

Diagnosis

Clinical signs.

Treatment

Regular treatment with ivermectin will eradicate the larvae in the nasal passages.

Control

It is not really possible to avoid the fly. In areas with a problem, routine treatment with ivermectin in late summer will help.

Diseases of the Lung and Deeper Airways

Sudden Onset (Acute) Pneumonia

Cause

Acute pneumonia is rarely caused by a single organism. Typically the disease starts with a virus such as ovine herpes virus (OHV) or parainfluenza virus 3 (PI3). These can cause mild damage to the innate defence mechanisms of the respiratory tract. In turn, secondary invaders, such as mycoplasma (*M. ovipneumoniae*) or bacteria (*Pasteurella multocida* or *Mannheimia haemolytica*) can be established in the lung tissue to cause the disease.

Clinical Signs

As mycoplasma or bacteria start to grow in the lung tissue, they release toxins into the bloodstream. Animals appear generally sick; they separate from the flock, appear depressed and may back off their feed. Close examination will probably reveal that an infected animal is running a fever. As the lung tissue is damaged and the disease progresses, an animal will start to show laboured breathing, cough and have nasal discharge.

Diagnosis

Most causes of pneumonia are never truly diagnosed. Animals are simply treated. However, in situations where there is an outbreak and animals are dying of disease, a full post-mortem examination should be performed. Lung tissue taken from affected animals can be processed by the laboratory to find the agent causing the disease. Tissue cultures are most valuable in animals that died before any treatment was given. This will allow therapy to be tailored to the specific problem seen on your farm. To get the most value from a

post-mortem examination, pick an animal that is typical of the disease you are seeing. Do not pick the worst affected or the most unusual. Also ensure the post-mortem is performed promptly after death or euthanasia. After death, the carcass will start to decompose rapidly and decomposition will severely affect the quality of the laboratory results.

Treatment

Most cases of pneumonia are treated with antibiotics. Because many pneumonias are viral in origin, antibiotics will not be of value in treating the primary pathogen but may help to control secondary bacterial invaders. Antibiotics used to treat pneumonia should be effective against the bacteria commonly associated with pneumonia cases on your farm.

Medication	Dosage Level	Regulated Use in Canada
Oxytetracycline LP (low pain)	Daily dose required as indicated on the bottle.	This is a sheep labelled product.
Oxytetracycline LA (long acting)	A single treatment is often effective.	This is a prescription drug for sheep and goats. ELDU
Tilmicosin	A single treatment is often effective. It is critical to follow the recommended injection technique. Do not use in goats; it is toxic.	This is a sheep labelled product. Tilmicosin is toxic to sheep if used incorrectly, follow the label! Tilmicosin is also potentially toxic to humans, use safely.

Refer to Appendix 1 for appropriate brand name medication

Prevention

Many cases of pneumonia require some sort of predisposing factors which allow the infectious agent to overcome the animal natural defences. Follow good husbandry management practices.

Common Risk Factors

Housing

Whenever animals are housed, the air quality in the building will always be lower than when they are outside. The air becomes more humid and carries more particles from feed and bedding. In addition, bacteria and viruses that are breathed in and coughed up by animals are not simply blown away; they continue to circulate within the enclosed space. The number of particles in the air can simply overwhelm the lung's natural defences, which leads to disease.

Stress

Stress causes the animal to secrete the stress hormone, cortisol, into its circulation. Cortisol has many functions; one is to suppress

the effects of the animal's immune system. Stress can, therefore, make the animal more prone to disease, especially pneumonia.

Mixing

When animals from different sources are brought together each animal brings its own population of viruses and bacteria with it. Each animal is immune to its own population. When the animals are mixed they suffer stress, which decreases immunity. They can then become overwhelmed by the mix of bacteria and viruses from the other animals. This is especially true when animals from multiple sources are mixed, so this situation should be avoided if possible.

Weather

Sudden changes in weather, especially temperature, can affect the lung's ability to deal with infection, which can predispose animals to infection.

Prevention Strategies

If animals are housed, ensure the barn is well ventilated. If necessary, contact an extension specialist to assist in developing an effective ventilation strategy. As a rule of thumb, if a barn seems stuffy or smelly, ventilation is inadequate. If the air in your barn makes you cough, it is not healthy for your flock either.

Common stresses affecting sheep and goats include weaning, transport, mixing, handling and vaccinations. While it is not possible to avoid all stresses, care should be taken to avoid compounding them. For example, weaning animals, moving them to the feedlot and mixing with other animals at the same time are all recipes for disaster.

Vaccination

In other parts of the world vaccines have been developed to control common causes of pneumonia. Vaccines developed for other species but which may be effective in your flock may be used, with a prescription.

Prophylaxis

This can be considered for high risk management styles where the occurrence of pneumonia can be anticipated, for example, animals arriving in a feedlot. Vaccination and management protocols to reduce the risk of animals' succumbing to pneumonia can be developed, once the risks predisposing the animals have been identified.

Atypical (Chronic Non-progressive) Pneumonia

Cause

This is principally caused by mycoplasma (especially *M. ovipneumonia*), often in association with other viruses and bacteria. The disease causes a low level pneumonia in young animals, especially when they are housed at high stocking densities. The disease is spread by coughing.

Clinical Signs

The disease is mild, with the main clinical sign being occasional coughing. There may be some nasal discharge. Typically animals do not run a fever. Severely affected animals will not grow as fast as others; animals rarely die. Affected feeder lambs eventually do become finished but the cost to get them there far exceeds the production cost of finishing unaffected animals.

Diagnosis

This diagnosis is usually made either at post mortem (for some other condition), or the disease is found when animals are slaughtered for meat.

Treatment

Although this disease causes reduced growth rate and coughing, almost all affected animals will recover and the lungs will heal. The quality of replacements retained in flocks where the disease is endemic may be affected; the animal's ability to thrive is compromised by the mycoplasma organism. Severe cases should be treated with antibiotics effective against the mycoplasma organism; consult with your veterinarian.

Control

The disease is normally controlled through good management practices, such as reducing stocking density and ensuring adequate ventilation of barns. If young animals are purchased, avoid mixing groups, to minimize the spread of disease.

Parasitic Pneumonia

Cause

Three lungworm species affect sheep and goats:

Dictyocaulus filaria

Muellerius capillaris

Protostrongylus rufescens

In all cases the larvae are ingested by the sheep. They then migrate to the lungs where they may cause disease. Fortunately these diseases are uncommon in western Canada.

Clinical Signs

Only *Dictyocaulus filaria* infection is truly associated with severe disease such as coughing, rapid respiration, nasal discharge and weight loss. The other worms cause very little damage to the lungs.

Diagnosis

Dictyocaulus filaria infection can be diagnosed using a special analysis of the feces from affected animals. (The test is different from a standard worm egg count).

Treatment

Fortunately all lungworms of sheep and goats respond well to commonly used dewormers such as ivermectin and others.

Control

Most lung worm problems can be controlled through an appropriate biosecurity program (Refer to *Chapter 22, Biosecurity*) and strategic management considerations.

Chronic (Slowly Progressive) Pneumonias

There are a number of causes of pneumonia in adult animals that are slow in onset and progressive, eventually leading to death.

Maedi-Visna (Ovine Progressive Pneumonia, OPP)

Cause

This is caused by the maedi-visna virus, a member of the retrovirus family. The virus infects white blood cells and the virus's genetic code is inserted into the cells. Over many years the cells' function becomes impaired and the affected cells start to build up in specific tissues, leading to disease. The most common tissue affected is the lung. The virus can be spread in a number of different ways:

1. The virus is present in colostrum and can spread from mother to offspring.
2. There is a small risk that a mother can pass it to her offspring while she is pregnant.
3. The virus is easily spread through blood, especially when needles are reused for injections.
4. The virus can spread through coughing.

Clinical Signs

The pneumonia (*Maedi*) form of the disease typically presents as exercise intolerance and increased respiratory effort. You will notice the sides of the animal moving with every breath, and animals may stand with their necks extended and breathe through their mouths. Animals do not run a fever.

The disease may also present in a number of different syndromes, including mastitis (refer to *Chapter 7, Hard Bag*) and neurological disease (refer to *Chapter 10, Maedi-Visna*).

Diagnosis

It is only possible to make a final diagnosis at post-mortem. However, animals carrying the virus can be identified by a simple blood test before they develop clinical signs, as this virus has a long incubation period.

Treatment

There is no treatment.

Prevention

The only way to prevent this disease is to eradicate it from the flock.

Always work with your veterinarian to determine if control or eradication of maedi-visna is right for you. The critical point for control is to test all sheep every year and cull any that are positive. In addition, you need to minimize the spread of disease by using new needles for all injections. The other component of control is preventing the spread from one generation to the next. Consequently, no offspring from affected dams should be kept for breeding. It is technically possible to remove newborn lambs from the mother before they consume colostrum. These animals should be fed colostrum from another virus-free source and be hand reared. They should then be free from infection. This technique, however, is very time and labour intensive; hence it is rarely implemented by producers.

Caprine Arthritis and Encephalitis (CAE)

Cause

CAE is caused by a virus which is very closely related to maedi-visna in sheep. However, it affects goats instead and although it more commonly causes arthritis and brain disease, it does occasionally cause a pneumonia similar to maedi-visna. (Refer to the previous section, *Maedi-Visna*.)

Caseous Lymphadenitis (CL)

In some cases the bacteria carrying CL can get into the bloodstream and spread to the internal organs, especially the lungs, where large abscesses can form. Affected individuals may exhibit signs of pneumonia and suffer significant weight loss. Most animals will also have signs of a CL abscess under the skin. There is no absolute way of making a diagnosis other than by post-mortem and culture. There is no treatment; animals should be euthanized.

Refer to *Chapter 8, Caseous Lymphadenitis*.

Lung Abscesses

An episode of severe pneumonia often leaves the affected animal with areas of damage in the lung. Over years these areas can become colonized by bacteria. The damaged lung forms an abscess. While there are often not signs of respiratory disease associated with this abscess formation, the animals do poorly and lose weight. Lung abscesses are an important cause of carcass condemnation at slaughter. (Refer to *Chapter 13, Poor Body Condition*.)

Jaagsiekte (Pulmonary Adenomatosis, Pulmonary Carcinoma)

Cause

This is caused by *Jaagsiekte* retrovirus, a virus is similar to the one causing maedi-visna. The virus inserts itself into the DNA of a sub-population of cells in the lungs. The virus may then cause these cells to become neoplastic, leading to the development of a specific lung tumour. The virus is spread by coughing and takes many years to develop.

Clinical Signs

The disease typically affects sheep aged two to four years of age. This disease also occasionally affects goats. These animals have difficulty breathing if you attempt to drive them; they collapse from exertion (Jaagsiekte - means *moving disease* in African). Animals do not have a fever.

Diagnosis

If you lift an animal up by the hind legs (wheel barrow test), large amounts of fluid will pour from the nose, fluid which has been accumulating in the lungs because of the cancer.

Treatment

There is none. These animals should be humanely euthanized.

Control

Control consists largely of culling affected animals early to prevent spread of the disease. If the disease has high levels in your herd, you may consider culling the offspring of affected animals.



13. Poor Body Condition (Old Thin Ewe/Doe)

There are a number of possible causes for poor body condition in old ewes/does. The most common include:

- Malnutrition
- Broken mouth
- Parasitism
- Johne's Disease
- Maedi-Visna/Caprine Arthritis and Encephalitis (MV/CAE)
- Caseous Lymphadenitis

Due to their fleece, sheep in poor body condition are often hard to spot. Since goats carry much of their body fat in their abdomen it is also hard to spot animals in poor body condition. Producers must become experts at body condition scoring. Refer to *Body Condition Scoring* in the *Nutrition* module. An approach to diagnosing causes of weight loss is described in *Chapter 23, Treatment Protocols for Disease*.

Malnutrition

Cause

Failure to consume sufficient nutrients to maintain the animal's physiologic needs. A number of factors can come together, resulting in malnutrition, including:

- Feed, water and mineral availability.
- Feed quality.
- Stocking density.
- Animal hierarchy within a group.

Feed bunk capacity.

Feed bunk management.

The animal's physiologic state and the metabolic demands of that state, for example, pregnant with triplets versus carrying a single.

These factors may affect either individual animals or the entire flock.

Clinical Signs

Poor body condition.

Diagnosis

Requires a careful examination of the diet and eating habits. Older ewes and does with or without other health problems may not be able to compete effectively with the rest of the flock/herd; they may not have as much access to the feed as you assume. Observation of the flock/herd at feeding time may give you some indication of how individuals within the group access their feed. The presence of feed does not rule out malnutrition.

Feed quality can only be determined accurately by analysis. Someone with a nutrition background can best formulate a cost-efficient diet that optimizes the animal's requirements and owner's feed costs. A veterinarian or animal nutritionist can assess the ration to ensure it provides sufficient energy, protein, vitamins and minerals for each different type of animal at different stages of its production cycle.

Treatment

If the ration is deficient, it should be reformulated and new feed acquired. If a small number of animals are affected they should be separated from the flock and thoroughly examined, to rule out other potential diseases; they should then be fed a high quality ration for several weeks to see if their condition improves. Often you will observe an improvement in general demeanour before you see an increase in body condition; the animals will be brighter and more active. Weight gain takes time, so be patient.

Prevention

Always have feed ingredients analyzed, to ensure you are feeding a balanced ration. It is not possible to assess the nutrient quality of any feed by sight or smell alone. This is a management disease but one that affects both small and large flocks. To be able to control this

syndrome you should be aware of your animals' general body condition and nutritional demands.

Broken Mouth

Cause

The cause of this problem is bacterial infection at the base of the front teeth at the gum junction (gingivitis). The infection weakens the tooth attachment to the jaw and the teeth are eventually lost. The disease is an important cause of culling in all parts of the world. The incidence of the disease varies by region and by flock and the risk factors for development are not well understood. Sheep on marginal land seem more prone to the condition than those grazing higher quality pastures.

Clinical Signs

Often the first sign of disease noticed (unless animals are regularly checked) is poor body condition. Examination of the incisors is all that is required to make a diagnosis. The gum line may be swollen, bleeding or both, and there may be pus present. As the disease progresses the gums regress, exposing more of the tooth root. Eventually the tooth is lost.

Treatment

There is no treatment for a broken mouth. Many of these animals are culled. It is possible to keep these animals but they require individual care and access to high quality feeds.

Prevention

There is no way of preventing broken mouth at the present time.

Parasitism

Cause

Infection with a wide variety of parasites may lead to poor body condition. Refer to *Chapter 20, Parasite Control*.

Clinical Signs

Parasitism typically results in soft feces or diarrhea. There will likely be a history of inadequate parasite control or atypically hot weather.

Diagnosis

Fecal analysis for worm eggs.

Treatment

Treat with a dewormer.

Prevention

Develop a deworming schedule with your veterinarian. Refer to *Chapter 20, Parasite Control*.

Johne's Disease

Cause

The cause of Johne's disease is a bacterial infection of the intestines by the *Mycobacterium avium* subspecies paratuberculosis. The bacteria are shed in the feces and ingested, infecting young animals. Typical routes of ingestion would be via fecal contamination of the mother's teats or contaminated feed. Once in the intestines the bacteria cause disease very slowly. Most animals show clinical signs between two and seven years of age. The bacteria cause thickening of the gut, resulting in a failure of normal digestion that leads to malnutrition.

Clinical Signs

The main clinical sign of Johne's disease is weight loss despite a good appetite. Diarrhea (the main clinical sign in cattle) is rare in sheep and goats.

Diagnosis

Diagnosing Johne's disease is difficult. Fecal culture is the best test, but it might be four months before laboratory results are known. There are a number of blood tests available. However, false negative results are possible early in the disease because of its long incubation period.

Treatment

There is no treatment. Infected animals should be humanely euthanized.

Prevention

The mainstay of Johne's disease prevention is eradication. Never buy animals from an unknown source where there is no information regarding the Johne's status of the flock/herd. All clinically ill animals suspected of having Johne's disease should be culled. Lambing/kidding areas should be maintained in a sanitary manner; animals (especially young animals) should not be fed off the floor. There are other strategies that can be used to help control Johne's disease. Discuss these with your veterinarian.

Maedi-Visna/Caprine Arthritis and Encephalitis (MV/CAE)

Cause

CAE is caused by a retrovirus. Refer to *Chapter 12, Maedi-Visna*.

Clinical Signs

This disease is most commonly associated with chronic pneumonia (lungs) and arthritis (joints); it can also affect other organs. It presents itself as slow weight loss.

Diagnosis

The diagnosis is mainly based on a blood test for the virus.

Treatment

None is available.

Prevention

Refer to *Chapter 12, Maedi-Visna*.

Caseous Lymphadenitis

Cause

The cause of this disease is by a bacterial infection by *Corynebacterium pseudotuberculosis*. (Refer to *Chapter 8, Caseous Lymphadenitis*.) Most animals infected by caseous lymphadenitis develop abscesses in the skin lymph nodes. The bacteria occasionally enter the bloodstream, leading to the development of abscesses in internal organs.

Clinical Signs

Weight loss despite good teeth and nutrition. There may be evidence of superficial abscesses or a history of the disease in the flock.

Diagnosis

Not really possible.

Treatment

None.

Prevention

Consider an eradication program, including vaccinations.