

The Latest on Caprine Arthritis Encephalitis Virus (CAEV)

By Cheryl K. Smith

Caprine arthritis encephalitis virus (CAEV) is probably the most talked-about and contentious disease of goats, if not the most common. As one longtime goat owner explained to me, “in the 1980s goats were dying right and left from this disease, and it was horrible.” *That sounds like the AIDS epidemic.*

As a more recent goat owner, I don't see the same thing. While acknowledging that, ideally, CAEV should be eliminated, I wonder whether—like HIV in people—the most susceptible individuals got sick and died and the more resistant ones survived and went on to reproduce, giving us the disease we have today—a majority of goats that don't even show any symptoms of their status. This is not to deny that those goats that do experience symptoms of CAEV may have long, drawn-out, expensive and sometimes painful deaths.

CAEV was first discovered in a goat herd in Washington in 1974. In that case, some of the kids had developed a progressive paralysis of their hind legs, along with a mild interstitial pneumonia. The disease was determined to be caused by a virus that infected the nervous system and named “viral leukoencephalomyelitis” (inflammation of the brain and spinal cord). While adults in the herd also had a chronic arthritis, the two diseases were not linked until a few years later, when the CAE virus (CAEV) was determined to be the cause of both.

CAEV is a lentivirus, in the same family as the human immunodeficiency virus (HIV), which infects goats and sheep. A similar virus originally found in sheep causes the disease Ovine Progressive Pneumonia (OPP), also known as Maedi-Visna virus (MVV). Both CAEV and OPPV/MVV frequently cross the species barrier between goats

and sheep, so that now they are referred to collectively as small ruminant lentiviruses (SRLV). For the purposes of this article, I will use the term CAEV, since that is the term that most goat owners are familiar with.

In the 1980s more than 80% of goats were determined to have antibody to (be infected with) CAEV. That number is now estimated to be around 10–30% of goats in the US. The majority of these goats (70–80%) show no clinical signs. However, having antibodies to CAEV does not mean that the goat has immunity. Once infected with the virus, the goat will stay infected for its lifetime and be a carrier even if it is not sick.

Illness Caused by CAEV

CAEV has five major clinical presentations: arthritis, encephalitis, interstitial pneumonia, mastitis, and progressive weight loss. A goat may exhibit one or more of these.

The arthritic form is the most common manifestation of the disease, affecting mainly those that are six months old or older. It is generally chronic, progressive, and painful, affecting the joints and synovial membrane (lining of the joints). The goat may appear stiff, favor one or more legs, lose weight, avoid getting up and walking, and stand abnormally. In more severe cases, the joints are swollen and painful. (CAEV has been called “big knee” because of this expression of the disease.) Studies have found a genetic predisposition to developing arthritis upon SRLV infection, which explains why goats in some herds never develop this manifestation.

The encephalitic form of CAEV infection usually affects kids between two and six months old, but can affect older goats. The kids act uncoordinated and may stand or walk oddly. Gradually they become paralyzed, usually in the back legs, and are unable to stand up. Sometimes they may be able to drag

themselves by the front legs, and remain bright, alert, and responsive and do not have a fever. Because the disease is progressive, they eventually will develop further neurological symptoms, including depression, blindness, circling, tremor, difficulty swallowing, seizures and, ultimately, death.

Chronic interstitial pneumonia (inflammation of the connective tissue of the lung) is the form of CAEV infection that most commonly affects sheep, but also occurs in goats. The animal first develops a chronic cough, which leads to difficulty breathing, weight loss, increased rate of breathing and abnormal lung sounds. Enlarged lymph nodes may contribute to some of the respiratory distress.

Mastitis, especially interstitial mastitis (inflammation of the connective tissue of the udder), is another expression of CAEV. The udder becomes hard and distended, and often milk cannot be expressed. It often comes about around the time of kidding. Studies of milk production in goats with CAEV-caused mastitis have found conflicting results—from no reduction in milk production to 15% reduction.

The final major form of CAEV infection is chronic progressive weight loss. While wasting may be the only sign of CAEV, it often occurs with the other forms of the disease.

As previously mentioned, many goats will never show clinical illness from CAEV. Some of this may indicate the strain of virus that they have, but it also may have to do with whether they are well-fed, safe, live in a clean area and are not overcrowded. Stress can be a huge factor in bringing on clinical illness.

Transmission

CAEV lives in white blood cells and, consequently, can be spread through body fluids. It is transmitted from dams to their kids through colostrum and

milk, which contain the virus. It also may be spread by long-term contact between seropositive and seronegative goats, through contaminated milk in milking equipment, or through blood on contaminated needles, clippers or dehorers.

It may be found in semen, but without an infection in the buck, breeding a positive buck to a negative doe is not considered problematic. However, a recent study found viral DNA in both pre-breeding and post-birth genital secretions of positive does. A 2012 study also found that infected frozen semen can pass CAEV to does that are inseminated with it.

There is still a question about transmission of the disease to kids during pregnancy and birth. An ongoing study showed 23% of kids of positive dams that were seronegative at birth and fed with heat-treated colostrum went on to test positive for CAEV. Investigation is ongoing.

Sheep and goats can be a source of CAEV or OPPV (MVV) transmission to each other. Close contact between the two species in crowded barns has been suggested as one mode of transmission. In experiments, lambs that nursed from infected goats became infected with CAEV. In one case, a goat was found to be naturally infected with a dual MVV and CAEV strain.

In Switzerland, where CAEV-caused disease was considered to be virtually eradicated in goats, a version was found that appeared more closely related to OPPV (MVV) than CAEV by blood testing in seronegative goats. This indicates that the sheep population

is a potential source of infection for CAEV-free goats. The results of a recent epidemiological study support the conclusion that contact with seropositive sheep is the most significant risk factor for CAEV infection in CAEV-free goat herds.

Recently a gene has been found in sheep that can make them resistant to OPP. In addition, in some African countries where antiretroviral drugs are not available, several studies have found that exclusive breastfeeding reduces the transmission of HIV, and feeding of breast milk AND artificial baby milk increases the transmission. So it is possible that some goats may be resistant.

The virus, like HIV, is also mutating. Recently a new lentivirus was found in goats in Italy that was neither OPPV or CAEV. The two original viruses, once considered distinct, are now viewed as part of a continuum.

Incubation Period

The incubation period is highly variable. Most goats become infected when they are very young, and develop disease months or years later. Encephalitis has been reported in a one-month-old kid.

The speed at which goats convert to positive may span a wide range—from a few weeks to several months, making a reliable blood test for CAEV quite difficult. Even with dams that were known to be positive, and exposure to the colostrum and milk, kids have been known to test negative more than seven months after birth.

According to the Washington Animal Diagnostic Disease Laboratory

(WADDL), “These ‘silently’ infected animals test negative for antibody until the viral infection is activated by stress or other factors. It has not been determined whether these goats [are] infectious to other goats during the time they harbor the virus but remain seronegative.”

One study found that antibodies to CAEV were not detected in 95% of kids (that were fed heat-treated colostrum) by 93 days after birth. All kids in that study were seronegative by 108 days, suggesting that goat keepers may begin testing kids at 3 to 3.2 months of age instead of the previously recommended four to six months.

Diagnosis

Besides a diagnosis based on clinical symptoms, blood testing is the easiest and most common method to determine whether a goat has CAEV. Two blood tests are available in the US: the Agar gel immunodiffusion (AGID) and the enzyme-linked immunosorbent assay (ELISA).

The AGID is the prescribed test for international trade. The ELISA is considered to be the most reliable of the two tests and is recommended by most goat vets and goat breeders. Both tests are about as reliable, but neither is 100% accurate.

In addition to the ELISA and the AGID, several methods based on the polymerase chain reaction (PCR) have been developed to detect CAEV through DNA testing; they are used mainly to detect positive status in animals that

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tested negative with ELISA and/or AGID. This test is not yet widely available, but in a 2008 study it was found to detect CAEV in four of 34 goats that had tested negative by AGID. The authors noted that “PCR may be a useful tool for decreasing the risk of breeding AGID false negative animals (CAEV carriers).”

A true positive result from any of these tests means that the goat is infected with CAEV. A negative result means that the goat either is not infected, or has been exposed but is not producing enough antibody to be detected. If there is reason to believe that the goat may be infected, it should be re-tested.

All seronegative goats should be re-tested every six months, unless they live in a closed herd (NO new goats introduced, no exposure to sheep [unless in the same closed herd] and goats not exposed to goats from outside the herd).

Treatment

No cure/treatment exists for CAEV

and, to date, no vaccine has been developed. When a goat does develop symptoms, the symptoms are treated accordingly. However, because CAEV is a chronic disease, treatment may be ineffective and the best that can be done is to keep the goat comfortable or euthanize it.

Strategies for Dealing with CAEV

There are several strategies for dealing with CAEV in a goat herd, and goat keepers may elect to use one or a mix of them. The first strategy is simply to avoid buying infected goats. Get a written contract for the sale, if you are unsure about the seller. Ask the seller if/when the herd is/has been tested, whether the herd has/had CAEV, and if so, how it was managed. To be extra sure, quarantine a new goat for 30 days and have it tested for CAEV yourself.

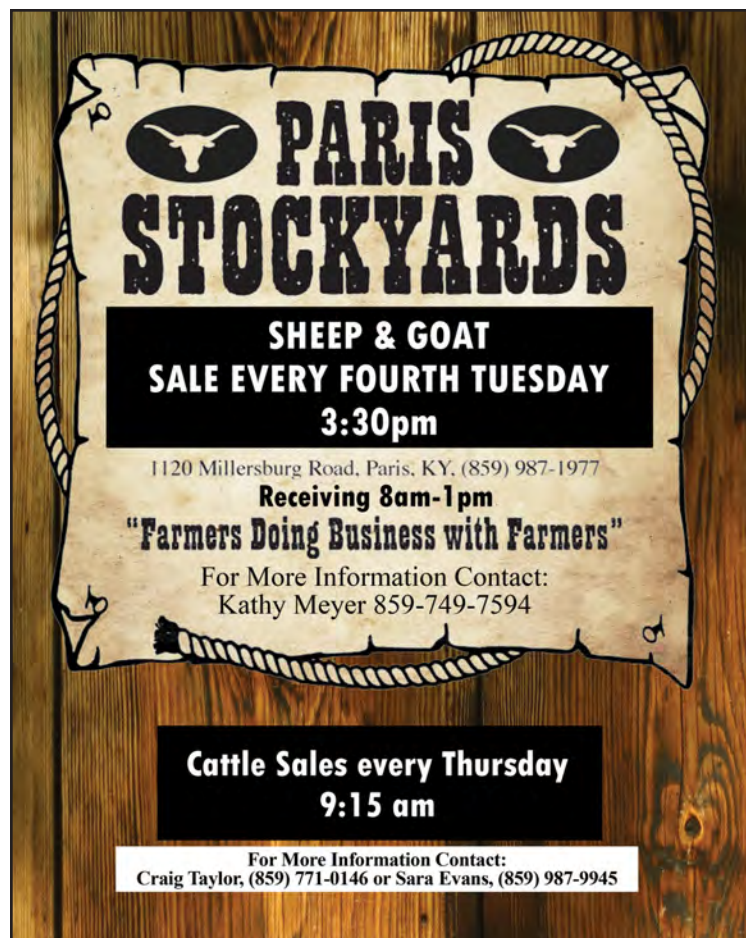
If a recently purchased goat tests positive, ask the seller to take it back

and refund your money. This is one area where a contract is useful.

Some individuals either euthanize or sell at auction any goat that tests positive for CAEV. Euthanasia seems rather extreme to me, considering that the animal has a good chance of never getting sick. But for some, even that small risk may be too much. For others, having to snatch the kids and rear them separately also may be too time- or resource-intensive. If sold at an auction, extremely important that the animal is sold for slaughter only!

If a decision is made to keep the animal(s), they should be allowed to live as stress-free a life as possible, and be properly fed and cared for. If a goatkeeper has more than a few goats and breeds them, a couple of options exist.

First, if no animals leave the farm for breeding or pet purposes (for instance, the goats are freshened and extra kids are butchered), the kids can stay with their dams and CAEV serological



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status need not be addressed. If finances permit, testing twice a year or annually would be interesting simply for informal research purposes to see whether or when they become positive and/or whether positive goats exhibit any signs of the disease. If some goats in the herd stay seronegative, tracking whether their kids are also CAEV-negative would give some information on potential resistance to the disease.

The second option is to separate the kids from the seropositive mothers immediately after birth, raise them in a separate area on heat-treated colostrum and pasteurized milk or a substitute, such as safe (free of Johne's, mycoplasma or other transmissible diseases) goat or cow colostrum and routinely test all CAEV-negative goats. Make sure that CAEV-negative goats have NO direct contact with the CAEV-positive goats or sheep. This is the strategy of choice for breeders who plan to take their goats off the farm or sell them, as well as for those who want to eliminate CAEV from their herd.

Because of the risk of intrauterine or birth-related infection, even a goat raised under the second option is not 100% safe from getting the disease. This is one reason that routine testing is so important. If a kid tests positive after being pulled from its dam and fed heat-treated colostrum and pasteurized milk, it should be moved into the CAEV-positive herd or culled.

A CAEV-negative herd is worth working toward. With no CAEV in the herd, dams can raise their kids, giving them colostrum to boost their immune systems, raw mother's milk for the best nutrition possible, and mother-to-kid contact so they can bond and learn to act like goats. Goat keepers can also feel secure in not worrying about one more health issue for their goats and not inadvertently selling a CAEV-positive kid.

Cheryl K Smith is a writer and editor who has raised miniature dairy goats in the Coast Range of Oregon since 1998. She is the author of *Goat Health Care* and *Raising Goats for Dummies*, and writes and speaks on goat health and goat midwifery. This article is an updated version from *Goat Health Care*.

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