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EPIDIDYMITIS IN RANGE AND PUREBRED RAMS

Clell V. Bagley, DVM, and Mark C. Healey, DVM, PhD

Ram Epididymitis (RE) is the major cause of reduced fertility in rams from western range flocks. This common disease is found in 95% of Utah range flocks, and affects an average of 35% of the rams in a flock. Although the disease has been present for many years, some producers have only recently become aware of RE. The clinical signs of the disease are subtle and one must actively look for RE to find it.

There are two different forms of the disease; one is contagious and the other is an opportunist. These must be considered as two separate diseases, although they cannot be differentiated by the clinical signs. One disease syndrome is found almost exclusively in range flocks and is caused by a contagious bacteria, Brucella ovis. The other disease syndrome occurs mainly in ram producing flocks and is commonly referred to as lamb epididymitis (LE). The opportunistic bacteria causing the LE is usually Actinobacillus seminis or Hemophilus somnus. These organisms are often present in normal rams.

The greatest problem with RE occurs in range flocks. Once a resident flock is infected, the infection gradually spreads through resident rams and into new rams (replacement rams) as they are added to the flock. An economic evaluation by Colorado State University (CSU) showed that the average level of infection in a range flock costs a producer $11.67 per ewe, per year. A range flock producer can now eliminate this disease and these losses by eradicating the B. ovis organism from his flock.

Lesions of RE

The epididymis is a single, long (160 foot) duct of very small diameter, which is coiled into numerous loops. The epididymis is divided into three distinct areas; the head, body and tail. Its function is to collect and store sperm cells produced in the testicle and gradually transport these immobile sperm from the testicle to the vas deferens in preparation for ejaculation.

Figure 1: Comparison of a normal (left) and infected (right) testicle and epididymis. Note the presence of scar tissue and the adhesions of the tunic on the right testicle and epididymis.

Epididymitis is an inflammation of this long tubular structure. The inflammation may be caused by injury, but is usually due to a bacterial infection. As the body defenses respond to the infection by inflammation, scar tissue is formed in and around the epididymis. This usually results in partial or complete blockage of sperm transport from the affected testicle. This scar tissue can usually be felt as a rounded, hard mass upon palpation of the infected testicle, usually in the area of the tail of the epididymis. The inflammation may also cause adhesions between the surface of the testicle and its tunic or covering membrane (Figure 1). Other areas of infection and inflammation (pathology) may also occur in the reproductive tract of the ram.

These inflammatory changes of the epididymis and reproductive tract usually reduce the quality of semen and may completely prevent the transport of semen from the infected testicle. Most rams are still able to produce some semen from at least one testicle, so only a small percent are sterile. However, the majority of affected rams do have reduced semen quality and lowered breeding capacity (Figure 2).

Causative Agents

1. RE in Range Flocks:
Most RE in range flocks is caused by the bacterial agent Brucella ovis. This is the contagious form of RE that is spread from infected to uninfected rams. Occasional cases in range flocks may also be caused by injury and by other bacterial agents (see #2; **LE in Ram Producing Flocks**).

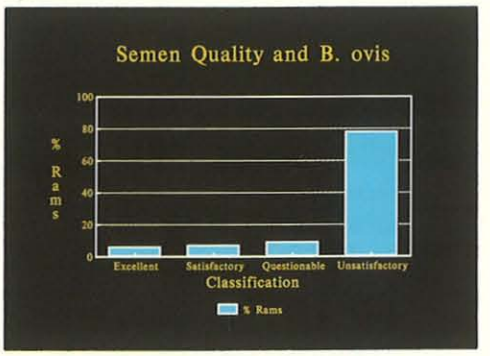

Figure 2: Semen evaluation of rams infected with B. ovis. The majority of these rams had unsatisfactory or questionable semen, although most showed no evidence of palpable lesions.

Some infected rams carry the B. ovis infection elsewhere in the reproductive tract, such as in the seminal vesicles, but develop no palpable, epididymal lesions. As a result, these rams escape detection by palpation, but continue to spread B. ovis to other rams. The disease may be transmitted by either homosexual activity or from ram to ewe to ram during breeding.

The ewe serves as a mechanical carrier and usually does not remain infected for prolonged periods. The disease does cause some embryonic death, abortions and birth of weak lambs from ewes bred by infected rams. However, the primary effect on the flock is the reduced fertility of infected rams. Cull ewes should not be allowed to run with the ram flock. Some of these ewes may be bred even out of season by infected rams and then these infected ewes serve as a source of exposure for other rams in the flock. The only time that rams and ewes should be mixed is during the planned breeding season.

Replacement rams introduced into the flock are usually free of B. ovis infection, but will often be exposed to B. ovis after entering the flock. This exposure comes either from infected resident rams or by breeding recently infected ewes.

2. LE in Ram Producing Flocks:
Epididymitis also occurs in rams of lamb to yearling age as they are being grown out for breeding stock by purebred producers. The bacterial agents involved with this form of epididymitis are usually either Actinobacillus seminis or Hemophilus somnus. These organisms have been found in many normal ram lambs. They are considered to be "opportunists" that are often present and only produce disease when induced by other forms of stress.

These organisms have not been shown to be contagious, although the patterns of occurrence in some flock outbreaks would appear to support that theory. Alternatively, these patterns could be due to incompletely understood environmental or hormonal conditions that affect many ram lambs within the flock at the same time.

Many producers feed antibiotics to aid in reducing the incidence of LE during this "growing-out" period for ram lambs. An experimental vaccine for these organisms has shown promise and could soon be available for use.

The B. ovis organism does not occur in ram producing flocks unless the ram lambs have been rented out for use in infected range flocks, or older infected rams are mixed with the ram lambs.
The following recommendations will help producers reduce the incidence of LE in ram lambs and yearling rams in ram producing flocks:

a. Keep ram lambs separate from adult rams.
b. If any ram lambs are used for breeding, they should be the first rams used in the flock that season. Ram lambs should not be mixed with any other rams and they should all be removed when their planned breeding period is completed. They must then be kept separate and not mixed with other virgin ram lambs.
c. Palpate all ram lambs monthly, after weaning, and remove any with lesions.
d. Feeding low levels of antibiotic during the growing-out period has seemed to reduce the incidence of LE, especially at times of stress or mixing of pens. These are the times when most cases of LE seem to occur.
e. Establish your flock as "Certified B. ovis Free" by achieving two negative blood tests and an annual negative test of all rams over six months of age.

The ELISA

An ELISA blood serum test has been developed which identifies rams that have antibodies to B. ovis. This method of detection enables the producer to identify and cull infected rams before they infect other rams. The ELISA depends on a color change to indicate a positive test (Figure 3A) and is read with an automatic microplate reader (Figure 3B).

The ELISA for B. ovis is currently being done at several laboratories in the western United States. Although there have been some differences in procedure, a concerted effort is now being made to standardize the test for all participating laboratories.

The ELISA is reasonably sensitive and can detect most rams that are infected with B. ovis (test-positive). However, the test sometimes fails to detect carrier rams. Approximately 5% of the rams that test negative on the ELISA are actually infected, which can allow for further perpetuation of the disease. Most rams that are positive on the ELISA have very poor semen quality (Figure 2). There may also be some false positive results (uninfected rams that are test-positive). This usually accounts for about 2% of the rams tested.

Most laboratories have a test category for "Suspects". Rams classed as suspect should be re-tested one month after the initial test. Suspect rams should remain separated from test-negative rams until the re-test results become available.

Control of RE

Unfortunately, the current control of B. ovis infection in range flocks has not been satisfactory and this is the reason that eradication is so strongly recommended. Although methods for a vaccine has been available for B. ovis RE for a number of years, it has not been effective and it interferes with the ELISA by causing false positive results.

Carrier rams often have white blood cells (pus) and separated sperm heads in their semen. This poor quality semen is chronic in nature and may not improve. Other infectious agents and heat stress can cause similar semen changes but the rams so affected usually recover and again have good quality semen.

Control of RE in range flocks by palpation, culling, and the feeding antibiotics aids in lowering the level of infected rams. But these methods result in the culling of a high percentage of rams every year, which becomes expensive for producers. A preferred strategy is to eradicate RE caused by B. ovis from individual flocks. The producer can make one of three management choices; 1) ignore the problem, 2) palpate and cull rams and partially control B. ovis infection, or 3) eradicate B. ovis from the flock.

Eradication of B. ovis

Field trials with cooperating producer flocks have demonstrated that B. ovis can be eradicated from individual flocks. A free flock will remain free of B. ovis unless the organism is re-introduced (Table 1). However, if eradication efforts are neglected and even one infected ram remains in the flock, the problem will quickly recur.

Producer costs to achieve B. ovis eradication will include costs for replacement of two-thirds of the rams culled, lab fees for the ELISA blood test, and labor and veterinary fees for blood sampling and handling. The major expense is incurred early in the process. If a producer tests once, culls, and then discontinues the eradication effort, he will waste a significant amount of money and time.

Most producers also use 3 to 3.5 rams per 100 ewes (3-3.5%). A ratio of 2.0 is adequate, if the B. ovis infected rams are removed and those remaining are healthy.

Whatever method of eradication is chosen, be sure to identify all rams with a good, individual ear tag. It would be good insurance to use two tags because some will be pulled out. One cannot afford a mix-up of rams because of a tag number problem. Most producers replace about one-third of the ram flock each year.

There are three options available for eradication. These include (1) repeated testing and culling, (2) separation of newly purchased rams, or (3) culling of the entire ram flock. These three options should be considered carefully and the one selected which best fits the specific operation.

Eradication Alternatives:
1. Repeated testing and culling. Test all rams every 30-60 days and cull all positive rams. Continue this process until two consecutive negative flock tests are achieved, and then monitor the ram flock with at least one annual test for two additional years. It is best to test in March, May, July and September. If the last two tests are not negative, change to option (2).

Expect 15-40% of the rams to test positive on the first blood test, even if you have been culling rams based on palpation. Approach the program vigorously, since missing just one infected ram can soon return the flock to a status of 15-20% positive.

Rams classified as suspect on the blood test should be retested before being culled. If possible, keep them separated until the retest results become available. Be aware that a few rams may test negative even though they are infected with B. ovis. The purpose of the repeated testing is to detect these test-negative rams.

2. Separation of Newly Purchased Rams. If new rams added to the range flock can be kept free from B. ovis, the normal replacement rate will clear the flock of infection in two years. This is possible since one-third fewer rams will be needed if they are free of B. ovis, and because one-third of the rams can be replaced annually.

We recommend that the resident ram flock be blood tested once in February or March, so the producer knows the extent to which B. ovis is present in his flock. All positive rams should be culled at that time. Only a small percentage of the positive rams will have good semen quality and the more infected rams present, the greater will be the spread of B. ovis within the flock.

As replacement rams are purchased, keep them separate from the resident rams. Buy only blood test negative rams and test them once more after purchase. During breeding, use the new rams first and then remove them from the ewe flock before putting in the resident rams. If 1% of the new rams are used for 16-20 days, approximately 75 to 85% of the ewes should be bred. These new rams must always be kept separate from the infected resident rams.

After breeding, remove the resident rams from the flock. Cull all resident rams or keep the two ram flocks separate for one additional breeding, and then cull the remaining resident rams. Blood test all the replacement rams in February or March, just to be sure that they are all still free from B. ovis infection.

3. Culling the Entire Ram Flock. If a producer knows from previous testing efforts that he has a relatively high rate of B. ovis infection in the current ram flock, the most rapid and perhaps cheapest method of eradication is to cull all of the rams after completion of breeding. This will save significant feed and death loss costs between breeding seasons. Replace with new, test negative rams so that 2% are available at breeding. These rams should have two months from purchase to breeding for adaptation and should be exercised and in good body condition.

The economic evaluation by CSU showed that for a flock of 1,000 ewes, all the rams could be culled and replaced at a cost of $6,000. If the average expected benefits were achieved, replacement of all rams would result in an increased income and savings of $11,670, or a net increase of $5.67 per ewe.

As producers cull test positive rams, it is important to recognize that not all of these rams are sterile. Many rams would be capable of settling some ewes. However, culling these rams is part of the price that must be paid to eradicate B. ovis. Most infected rams have reduced semen quality and fertility. When B. ovis eradication is achieved, the long-term benefits will be well worth the short-term costs.

Two major problems to be anticipated in a B. ovis an eradication program are (1) careless management, and (2) failing to complete the program. Careless management will result from lack of adequate ram identification, errors in ram separation, and failure to blood test all rams. Failure to complete the program will result in high initial costs without the long term benefits.

Protecting the B. ovis-free Flock

1. Range Flocks:
Once B. ovis has been eliminated from the range flock, do not mix these rams with rams from other flocks. Moreover, do not lend or rent rams out and then return them to the flock. Buy replacement rams from a certified free flock or buy rams that are test negative. Be sure to test replacement rams one additional time after purchase.

Don't mix rams and ewes, except during the designated breeding period.

If you find some rams with palpable lesions in your B. ovis-free flock, recognize that this could be due to injury or organisms other than B. ovis. Separate and blood test these rams. If necessary, have them castrated and the lesions cultured. It is best to cull rams with lesions after testing, even if they are blood test negative, since their breeding and/or fertility endurance are greatly reduced anyway. Testing of rams with lesions is essential for monitoring the flock status. The greatest threats of re-infection are:

a. Rams previously used for breeding,
b. Ram lambs that have been rented to another flock before purchase,
c. Mixing with other rams, and
d. Mixing with other ewe flocks during breeding.

2. Ram Producing Flocks: Establish a "Certified B. ovis Free Flock" by testing all rams over six months of age and obtaining two negative flock tests 30 to 60 days apart. Maintain this flock status with one annual test of all resident rams and two negative tests on all replacement rams, unless the replacements are from a Certified Free Flock.

There has been a concern among purebred breeders regarding false-positive blood test results. Although this is always a slight possibility, one flock of 50 rams that were expected to be B. ovis-free were tested monthly from October through May and all remained negative. The false-positive test was not a problem in this flock.

Benefits From Eradication of B. ovis

A major benefit of eradicating B. ovis from any flock is the use of fewer rams for breeding. Most range producers plan for 3-3.5% rams for breeding. After eradication of B. ovis, this can be reduced to 2% (or lower if semen evaluation is also done). The purchase, feeding and care of extra rams is expensive! Controlled studies conducted at CSU document an increase in the lamb crop of 11 to 17% following the eradication of B. ovis. Moreover, the percent of dry ewes can be expected to decrease by about 50%, with a shorter lambing period. This latter change has been so dramatic as to create space problems in some lambing operations because the ewe flock lambed so rapidly. Eradication of B. ovis from a flock can bring financial benefits for many years to come!

Table 1: Flock Eradication of B. ovis RE in Utah.
% Positive on the ELISA Test

Flock #	Number of Rams	Spring 1986	Fall 1986	Spring 1987	Summer 1987	Fall 1987	Spring 1988	Fall 1988	Spring 1989
1	22-27	0	0	0	0				0
2	41-81	20	20	0	0	0	0	0	0
3	43-110	56	28	4	2	3	1	0	0
4	29-61		52	4		0	23	0	0
5	31-75		38	14	3	6	4	0	0
6	25-60		38	20	18	0	16	0	5
8	43-64		48	12	4	2	2	0	0
9	49-84		52	16	4	4	0	0	0
10	33-67		15			14	3	3	0
11	25-55		24			32	2	0	0
12	19-24		5			4	0		0
13	28-36		32	4		0		0	0
16	169-292				21	6	5		12

Figure 3A: Automatic microplate reader.

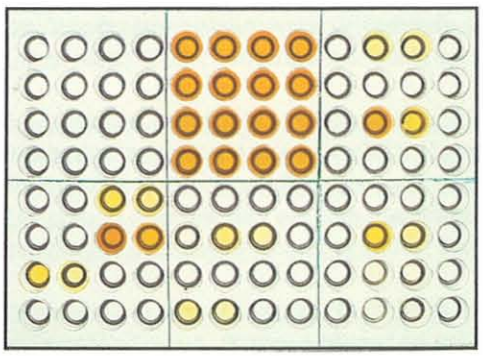

Figure 3B: An ELISA plate. The wells in the plate showing an intense orange color are considered to be positive and contain serum from rams having antibodies to B. ovis.

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