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Blackleg and Vaccination.

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Blackleg and Vaccination.

Blackleg, also called black-quarter and quarter-ill, and sometimes described in textbooks under the name of symptomatic anthrax, is a disease of young cattle caused by a germ, *Bacillus chauvæi*, and in Kansas causes a greater loss than any other disease of young cattle.

Foreign veterinary writers state that blackleg occurs among sheep and goats, but if it ever occurs naturally among animals other than young cattle, it is extremely rare.

CONDITIONS FAVORING BLACKLEG. It is the universal experience of stockmen that blackleg, as a rule, attacks young cattle that are in the best physical condition, particularly if they are gaining rapidly in flesh and are on excellent pasture, or are being fattened for the market on dry feed. By some stockmen it is thought that if young cattle are losing flesh rapidly they are also more likely to contract blackleg. A thrifty or fat condition of young cattle is favorable to the development of blackleg, and the only well-recognized condition that favors the disease. Sex or breed does not seem to make any difference in the susceptibility to blackleg.

AGE. Many cases of blackleg have been reported in suckling calves from two to three weeks old, but the disease is most likely to attack calves between six and eighteen months of age. After two years of age there is little danger, although a few cases are reported. Above three years of age blackleg is extremely rare, but does occasionally occur in aged cattle.

SYMPTOMS. One of the first symptoms usually noticed is that the sick animal remains apart from the herd, usually lying down and ruminating (chewing the cud). If the animal moves around it appears lame and stiff in one leg and moves the affected leg in a stiff and awkward manner. Exercise frequently causes some of the stiffness to disappear. Sometimes the disease affects more than one leg, and in some cases the neck is stiff, or the animal is stiff all over, or in one-half of the body only.

When examined closely the muscles of the affected part or quarter are found to be swollen and tense. At first the swell-

ing is small and painful, but as it rapidly increases in size the tenderness disappears and in a few hours the circulation is arrested and the part becomes cold and painless. This swelling is found to contain gas, which is shown by a drum-like feeling and a peculiar crackling or spongy sound when firmly pressed or rubbed with the hand. The presence of a large muscular swelling, which emits a crackling sound on pressure, is a characteristic symptom of blackleg. These swellings occur on the brisket and neck. They do not occur on the legs below the knees or hock joints, and are extremely rare on the belly. If the swelling is lanced a dark red, frothy, bloody fluid bubbles out. This fluid swarms with blackleg germs.

In the early stages the calf has a fever, the temperature often running to 105 degrees, but as the disease progresses toward death the temperature falls below normal (101 to 102 degrees). At first the mucous membranes, particularly of the eye and nostril, are congested and red, but later they have a dull leaden color.

Animals suffering from blackleg are often easily excited in the early stages, and if driven and disturbed will sometimes fight viciously. After an animal affected with blackleg gets down and unable to rise there is often some bloating noticed, particularly on the left side, but this bloating is due to indigestion, which may be induced by lying in one position. The bowels are usually constipated, a small quantity of dark-colored and rather hard dung being passed. Death usually occurs in from six to forty-eight hours after sickness is observed.

POST-MORTEM APPEARANCES. Practically the only abnormal condition noted in an animal that has died from blackleg is the altered appearance of the affected muscles. The muscles look as if badly bruised and filled with thick, dark blood and gases. The gas is noticed particularly in the connective tissue and blood, and occurs in bubbles. The connective tissue of the affected region often has a jelly-like appearance. Decomposition of the affected tissues and the contents of the digestive organs occurs rapidly after death and the body is soon badly bloated.

BODIES OF ANIMALS DYING FROM BLACKLEG SHOULD BE BURNED, OR BURIED DEEPLY, AND NOT LEFT ON THE SURFACE OF THE GROUND TO SPREAD THE INFECTION.

SEASON OF THE YEAR. Blackleg occurs at all seasons of the year. Reports show that in May and June and in September and October are the seasons when the greatest losses occur. The mortality from blackleg shows the heaviest losses in those seasons when the young animals as a rule are making the most rapid gains in flesh. In May and June young cattle are usually making excellent gains on the fresh pastures; in July and August there is generally a slight falling off in flesh, due to flies and the hot, dry weather. Later, as the grass matures and the cooler weather comes on, young cattle are usually in the best flesh of the year, and it is during this period of the year that the greatest losses from blackleg occur. The better physical condition seems to offer the most plausible explanation of the increased prevalence of blackleg at these seasons. There is also a slight increase of blackleg during the month of February.

MANNER OF INFECTION. Blackleg is generally considered by veterinary authorities to be a wound-infection disease. It is possible if infection with the germs of blackleg takes place through a wound that sores in the mouth, which are frequent in young cattle while they are cutting and shedding their teeth, may offer favorable places for infection. Experiments made by this department by drenching susceptible calves with infectious material have not been successful in producing the disease. Injecting the material under the skin does not always produce the disease. Another circumstance which is rather against the theory of wound infection is, that it is quite a frequent practice among stockmen to dehorn a bunch of calves as soon as blackleg appears, as there is a common opinion that this operation tends to stop the spread of the disease. If wound infection is a common method of contracting the disease, dehorning an infected bunch ought to offer favorable conditions for the spread of blackleg, but it does not seem to do so.

PERIOD OF INCUBATION. This is the length of time that elapses after the germs are introduced before signs of the disease appear, and vary, according to circumstances, from five hours to four or five days.

IMMUNITY. This is the power which an animal possesses to resist disease. Immunity may be natural or acquired; that is, an animal may possess immunity when born, or may acquire immunity afterwards. Swine possess a natural im-

munity towards blackleg; calves do not, but as they get older—from two to three years—they acquire immunity. This is called natural immunity. Immunity against blackleg may be acquired by having a mild form of the disease or by vaccination. Calves are vaccinated to give immunity against blackleg.

Calves seem to possess some natural immunity against blackleg. This natural immunity varies with different individuals, with different herds of cattle, with the physical condition of the animal, and apparently with the season of the year. There is no way of detecting the degree of immunity, except that they do not acquire blackleg when infected with germs of the disease. This varying individual immunity is also shown by the fact that when a dangerously strong blackleg virus is injected into susceptible calves, under the same conditions, a few will resist infection and will not contract the disease.

Immunity also seems to vary with different bunches of cattle. Experiments in vaccination indicate that a vaccine that has been carefully prepared and tested, when sent out and used by different individuals upon more than 10,000 head of cattle, will occasionally cause the loss of cattle as a direct result of vaccination. This would indicate that the natural immunity in these cattle was very weak. These results, however, are always complicated by the possibility that the vaccine was not properly used.

Blackleg Vaccine. Blackleg vaccine is made by taking the bruised looking diseased flesh from an animal affected with blackleg. This meat is cut into thin strips, dried, and ground into a fine powder. This powder is wet with distilled water and weakened or attenuated by heating from six to seven hours. The higher the temperature and the longer the vaccine is heated the weaker it becomes. After being weakened by heat the vaccine is again ground into a very fine brownish powder, and is sent out in this form. Two kinds of vaccine are made and distributed by this department. Each vaccine is put up in ten and twenty-five dose packets only. These are doses for yearlings or over. A single vaccine that requires but one vaccination is put up in red paper packets, and a double vaccine that requires two vaccinations about ten days apart is put up in white and yellow paper packets. Both single and double vaccine packets are plainly labeled, and on the back of the packet is stamped the date by which time the vaccine should be used, as it loses strength after a few months.

Single vaccine is made by heating the powdered blackleg meat for six and one-half hours at a temperature of 92 to 93 degrees. It is wrapped in red paper, in ten and twenty-five dose packets. The single vaccine requires vaccinating but once.

The double vaccine consists really of two vaccines. The first, a very weak vaccine, is made by heating the pulverized blackleg meat at a temperature of 99 to 100 degrees for six and one-half hours. This first vaccine is put up in white

papers, and, being a very weak vaccine, is intended to prepare the animal's system for the second, which is a strong vaccine. The second of the double vaccine is made by heating the pulverized blackleg meat for six and one-half hours at a temperature of 88 to 89 degrees, and is put up in yellow paper packets plainly marked.

The vaccine prepared by this department is made with great care, and is always tested upon some calves before being sent out.

Vaccinating Instruments. To use the vaccine it is neces-

sary to have a hypodermic syringe, mortar and pestle, graduate, funnel and filter paper. Such an outfit can usually be purchased upon the market for four or five dollars. To accommodate Kansas stockmen this department keeps a supply of vaccinating outfits on hand. By purchasing them in large quantities we are able to furnish them for \$3.50, complete. In some localities several stockmen own an outfit in common. The department also has on hand supplies for outfits, such as needles, plungers, filter paper, etc., which are supplied at cost. The outfit which we supply comes in a neat hardwood case. The accompanying illustration shows the box and its contents.

The Syringe. The vaccinating syringe holds five cubic centimeters; that is, sufficient for five yearling calves. The graduations are marked on the plunger stem. There is also on the stem a small nut which can be screwed down so that the dose can be accurately determined. The plunger of the syringe should be adjusted so that when the inside of the syringe is wet it will work smoothly. This adjustment can be regulated by pushing the plunger clear down and turning the thumb ring to the right or left, to tighten or loosen the plunger.

There is a screw cap (b) which should be kept on the

syringe when not in use, to protect it from dirt. A small washer should be kept on the nipple where the needle screws on, to prevent the vaccine leaking. Two needles (*c*) that screw on are supplied with each syringe. The needle points should be kept sharp by using an oilstone if necessary. A small wire (*d*) is furnished with each needle, to be inserted when the needle is not in use; this wire protects the point of the needle and keeps the dirt out. Do not put oil in the syringe, as it will ruin the rubber plunger and rubber washers at the end of the barrel.

STERILIZING THE INSTRUMENTS. It is very important that the vaccinating instruments be kept as clean as possible. After using the syringe it should be disinfected by filling with a five-per-cent solution of carbolic acid or a two-per-cent solution of creolin. This should be left in the syringe for a few minutes, then the syringe should be rinsed with clear water that has been boiled. The bottle, funnel and graduate should be treated in the same manner. Do not pour boiling water on the syringe, graduate, funnel or bottle, as they are liable to break. They may be placed in warm water which can be gradually brought to the boiling point.

If blackleg exists in the herd at the time of or just previous to vaccinating, the needle should be disinfected after each injection by dipping it into a strong disinfecting solution, such as a five-per-cent solution of carbolic acid. This is to prevent infecting other calves, should a calf having blackleg be vaccinated. Otherwise, other calves might become inoculated from the infected needle. Should any calves show symptoms of blackleg, they should be left until the last, and the instruments be thoroughly disinfected after vaccinating them.

AGE TO VACCINATE. Young cattle can be vaccinated at any age, although it is rarely advisable to vaccinate calves under four weeks old. Calves or young cattle should not be vaccinated when they are suffering from any debilitating disease, or when debilitated from shipping, driving, or a lack of feed or care. It is not advisable to vaccinate animals at the time they are dehorned or castrated, nor in cold, stormy or wet weather unless they are thoroughly protected. Calves under one year old should be vaccinated frequently—every three or four months, if possible. The younger an animal the shorter seems to be the period of immunity conferred by vaccination. After

the calf is one year old vaccination gives immunity for about five to six months; after five months, however, the immunity is much less, and while it is generally accepted that vaccinating twice a year will protect them, from observations made by this department vaccinating three times a year gives much better results. An excellent plan would be to vaccinate at one month, four months, eight months, one year, sixteen months, and twenty months. Frequent vaccination gives best results.

KIND OF VACCINE TO USE. This department supplies two vaccines—a single and a double. The single vaccine may be said to be about half way in strength between the first and second of the double. We ordinarily recommend the double vaccine, as it is a little safer to use and gives a little greater immunity or protection against blackleg than the single. If the calves are pure bred or in excellent condition, it is always advisable to use the double vaccine. This is especially true of calves that are on full feed. Under such conditions we recommend using the first of the double vaccine, after about a week or ten days use the single, then in ten days more the second of the double vaccine. Vaccinating with both single and double vaccine gives excellent results. If the number of calves to vaccinate is large, cattlemen usually prefer to use the single vaccine, as it saves the trouble and expense of handling the cattle twice.

When blackleg already exists in a bunch of young cattle, we advise using the single vaccine and in ten days the second of the double.

CONFINING THE ANIMALS. About the best arrangement for confining calves for vaccination is a narrow chute, where they can be closely crowded in. If many calves are to be vaccinated, a chute that will hold forty to fifty is very convenient. A footboard along one side, at a convenient height for the operator to stand upon, is excellent. With such an arrangement, and sufficient help to fill the chute quickly, 300 head an hour can be vaccinated. When there are only a few calves, a narrow stall, stanchion or chute makes a convenient place to confine them.

PLACE TO VACCINATE. There are several places on the animal where vaccination is commonly practiced. They are the shoulder, neck, tail, ear, and brisket. A good many vaccinate in the shoulder. This is a convenient place, as the skin is thin and there is considerable loose tissue beneath the skin. The

objection to vaccinating in the shoulder is the danger of sticking the needle into the flesh or muscles which cover the shoulder deeply. A convenient place to vaccinate is beneath the skin of the neck, just in front of the shoulder. The skin is thin and loose in this region. The needle can be easily and quickly inserted; there is little danger of sticking the needle into the flesh and no danger of the vaccine leaking out.

Fig. 1.

Fig. 2.

PREPARING VACCINE FOR USING. These directions assume that the vaccine used is the first of the double. Both the single and the second of the double are prepared in precisely the same manner.

Having the utensils and instruments perfectly clean, empty the contents of one or more of the packets in white paper, marked "first

vaccine," into the mortar, and add a few drops of boiled but cooled water to this, and with the pestle grind or rub it *thoroughly* into a thin paste; then add for each ten-dose package of vaccine used ten cubic centimeters of the boiled water, or, if the twenty-five dose packages have been used, add twenty-five cubic centimeters for each packet; add the water gradually, and continue to stir the mixture with a grinding motion of the pestle in the mortar. Then fold a filter paper,

Fig. 3.

doubling it first so as to form a half a circle, as shown in figure 1; then fold a second time, at right angles to the first, as shown in figure 2. Then open one side, and the filter paper will form a cone (figure 3) that fits exactly the inside of the glass funnel, in which it should be placed, and wet with some of the boiled water. Allow all the water to drain off and discard it. The funnel containing the filter paper is now placed in or over the bottle with the ground-glass stopper. Stir the vaccine which has previously been prepared in the mortar thoroughly, and then pour into the filter. Practically all of the liquid will pass through the filter, leaving the brown vaccine sediment in the filter. The filtered vaccine should be clear, or very slightly straw-colored. Should it be dark colored, or any sediment in it, there is probably a hole in the filter paper, and it must be refiltered through a new filter paper. The vaccine should be very carefully filtered until it is clear or slightly straw-colored. The straw-colored liquid is the material used for vaccination. Burn the filter paper containing the sediment; also burn the papers that the vaccine is wrapped in.

IMMEDIATE EFFECTS OF VACCINATION. If the vaccine is properly prepared and used, there are no visible effects following vaccination. The only way of telling whether the vaccine has taken effect is that the animals do not contract blackleg.

COST OF VACCINE AND OUTFIT. The vaccine is put up in ten and twenty-five dose packets, and costs two cents per dose. Vaccinating outfits complete, \$3.50. All orders should be addressed to the Veterinary Department of the Kansas State Agricultural College, Manhattan, Kan.

SUMMARY.

Blackleg is a germ disease, attacking young cattle from two or three weeks to two years old. It occasionally attacks older cattle.

The greatest loss occurs between the ages of six and eighteen months of age.

Calves that are in thrifty condition or fat are most likely to contract blackleg—particularly calves that are being fed for baby beef.

The greatest losses from blackleg occur during the months of May and June, and September and October.

The average loss among unvaccinated calves is probably between four and five per cent. Vaccination will reduce this loss to less than four-tenths of one per cent.

The younger calves are the shorter is the period of immunity. Young calves should be vaccinated every four or five months.

In vaccinating the vaccine should be filtered until it is clear, and care exercised not to inject the vaccine into the flesh, but into the loose tissue just beneath the skin.

Calves should not be dehorned or castrated at the same time they are vaccinated.

The Veterinary Department, Kansas State Agricultural College, Manhattan, Kan., furnishes blackleg vaccine, either single or double, to stockmen of Kansas for two cents per dose, to cover cost of making and distributing. Vaccinating outfits, complete, can be furnished for \$3.50.

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