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CONTAGIOUS ABORTION OF CATTLE¹

Contagious abortion, abortion disease, or slinking of the calf, is a disease of the first importance wherever cattle raising is an important industry. Its contagiousness was recognized by Europeans early in the eighteenth century, but the true nature of the disease remained a mystery until the development of the science of bacteriology made it possible for investigators to work out its cause and the manner in which it affected the animal body. In 1896, Doctor Rang, a Danish veterinarian, discovered the germ of abortion disease and since that time a great deal of investigation by many of the foremost scientists of the world has added to our knowledge concerning it.

To the cattle industry of Kansas, this disease is a serious and ever-increasing menace. Our breeding herds of beef cattle in pasture and on range have been hard hit, in many cases the losses amounting to nearly the entire calf crop. The dairy herds have likewise suffered. Heretofore dairying has not been an important industry in the state, but a considerable area is well adapted to that phase of animal husbandry and a determined effort is being made to develop it. Large numbers of dairy cattle are being imported from the so-called dairy states, where the disease is rampant, with scant attention to the danger involved. It would be most unfortunate should the growth of dairying in Kansas be greatly retarded because of this preventable disease.

1. This circular was prepared through the cooperation of the Extension Division of the Kansas State Agricultural College, and the Departments of Veterinary Medicine, Animal Husbandry, and Dairy Husbandry of the Kansas State Agricultural College. It embodies the best information that Veterinary Science and practical experience have to offer on the subject at the present time.

NATURE OF ABORTION DISEASE

This is a peculiar disease in that it seems not to affect the general health of the mother; but the germs gaining entrance to the pregnant uterus, set up an inflammatory process which breaks down the attachment between mother and offspring. The latter, unable to receive either nourishment or oxygen, dies, whereupon it becomes a foreign body and must be expelled. Other organs of the body are not involved, except that the germs are frequently found in the udder, where, however, no disease is produced. It is believed that the bodies of bulls and calves are not affected, but this point is still in controversy.

The disease is so chronic, requiring months for its development, and so insidious, being introduced by animals apparently normal in every respect, that it is hard for the average stockman to realize that he is dealing with disease. Mild symptoms and usually rapid recovery of the cow disarm suspicion. He believes that the loss of the calf due to accident or improper feed and so fails to take the necessary precautions. The first few cases are usually neglected and every opportunity is given for the spread of the infection. It is only after the disease is well established that the stockman realizes the seriousness of the situation.

The complications which attend this disease are more serious than the disease itself. Retained afterbirth, barrenness, the loss of milk in dairy herds and the lessened breeding efficiency in valuable herds are often of greater importance than the mere loss of calves. Calves may be born alive but so weakened because of the disease that they quickly die of other ailments or do not thrive.

CAUSE OF THE DISEASE

The primary cause of abortion disease of cattle is conceded by practically all investigators to be the abortion germ or organism, called the *Bacillus of Bang*, from its discoverer, Doctor Bang.

Investigators have been able to produce abortion experimentally in various species of animals by inoculating them with the abortion organism, but under natural conditions the disease does not readily spread from one species to another, as from cow to mare. Very peculiarly, the same result—

abortion — is produced in three different species of animals by three different organisms, there being one for the cow, another distinct germ for the mare and still another for the ewe.

The belief is common that injuries to the mother, eating spoiled feed, drinking cold water, etc., are the cause of abortion. Space forbids a discussion of these questions, but it is sufficient to say that nature has so well provided against these accidents that they are of slight importance compared with infection as the cause of abortion. It would be foolish, however, to deny the existence of contributory causes. It is a general principle that anything which lowers the vitality of an animal contributes to the development of disease; therefore, starvation, spoiled food, accidents, or other disease, may well assist in causing the death of the offspring. Recent investigations have shown that the reproductive function has been seriously interfered with where the pregnant animals were restricted to feeds deficient in the elements necessary for growth. Calves came dead or poorly developed and weak, while calves from properly nourished cows were strong and vigorous. This feature should be most carefully investigated to ascertain to what extent our present methods of handling and feeding our breeding herds influence reproduction.

SYMPTOMS

The act of abortion is but a symptom of the disease. The disease itself exists within the uterus, and the undeveloped calf is expelled because it can no longer live in the infected organ. For the dead calf to remain would result in its decomposition, and the life of the mother would be endangered through the absorption of poisonous products. The expulsion of the dead calf is therefore the first step in the process of healing.

The symptoms of approaching abortion are merely those preceding normal calving, and consist in the swelling of the udder, or making bag, and the swelling of the external genital organs. The swelling of the udder would be more apparent with beef cows and heifers than with cows in milk. Not infrequently the calf is expelled without any warning symptoms. Following abortion there occurs a characteristic, dirty, yellowish to brownish, flaky discharge that in turn gives place in a few days to purulent discharge, which may persist for several weeks unless proper treatment has been given. In addition,

there are certain inflammatory changes present in the body of the dead calf, the membranes, and within the uterus of the cow, which can be recognized by the expert.

Abortion may occur in susceptible cows at any period of their lives, from first pregnancy until 15 or more years of age. It may also occur at any time during the period of pregnancy. Young animals in first pregnancy usually abort early—at from two to four months—while older cows may carry calves five to eight months or even to full time. In very early abortions the calf and its membranes are expelled intact. In such cases the calf is often not found, there are no observable symptoms, and no disturbance in the health of the cow, consequently the owner thinks the cow failed to breed. Where abortion is delayed, retention of the afterbirth is a common occurrence. Retained afterbirth and sterility are also recognized symptoms of abortion disease.

COMPLICATIONS

Retention of the afterbirth is perhaps the most serious feature connected with the disease. Not only does it occur in connection with the untimely birth of the calf, but in a herd where abortion exists it is frequent even where the calves are born at full time and apparently healthy. In normal calving the membranes are quickly expelled. During pregnancy they serve as the attachment between mother and offspring through which the latter receives its nourishment. At the time of birth, however, that attachment is broken and the young animal begins to lead an independant existence, whereupon the membranes have no further function and become dead tissue. Normally they are quickly expelled, but where there has been disease the resulting inflammatory process causes adhesions between the membranes and the uterus of the mother, which are not easily broken down. These dead tissues soon become infected with the germs which cause decomposition. If proper treatment is not given, the protruding parts rot through and drop away, and the uterus closes upon the retained portions.

Nature attempts to remove this rotting mass, sealed up within the uterus, through absorption, and, the poisonous products of decomposition, and even the pus-producing germs themselves, are taken up by the blood. Blood poisoning results. There is an offensive, purulent discharge from the geni-

tal organs, the animal rapidly loses condition, and death is not uncommon. If the animal has sufficient resistance to survive, the inflammation within the uterus causes a thickening of its walls and the destruction of its lining membranes, so that there remains but a thick-walled sac containing a quantity of foul smelling pus. This completely destroys the breeding function and the animal is rendered permanently sterile. If she finally survives, she seldom regains her former condition of health. These serious results can often be prevented and the breeding function preserved to the animal by adequate treatment at the time of abortion, but neglect has caused the ruin of many a fine cow.

Barrenness, or sterility, is another common accompaniment of abortion disease. It may result, as just described, from structural changes which render conception mechanically impossible. Furthermore, it has been discovered that the formation of cysts within the ovaries operates to prevent breeding, and again, a chronic inflammation may have the same result. Experts are frequently able to remove these hindrances to breeding, but occasionally a case of barrenness is found where no structural defect can be detected and no other cause can be discovered. The reproductive function is one of life's processes so subtle in its operations that much still remains a mystery, and causes of sterility can not always be assigned or treatment prescribed.

METHODS OF SPREAD

It is necessary, before we can proceed intelligently to control a disease, to understand how the germs gain entrance to the animal body, and the methods by which they are carried from herd to herd. It has long been thought that the germs of abortion disease were introduced directly into the organs of the female by the bull at the time of service. Many cases cannot be accounted for in any other way. More recently, however, investigators have come to believe that infection may also enter through the digestive system by means of contaminated food and water. In the former case, the bull serves an infected cow, his genital organs become contaminated, and he transmits the infection mechanically to the next cow he serves, In the latter, the infected discharges from an aborting cow contaminate the food, the germs are carried into the

digestive system, where they are taken up by the blood and transported to the pregnant uterus, there to set up the disease which later results in the death and expulsion of the calf. In either case it is the infected cow that is the dangerous factor. Infection is doubtless most frequently conveyed from herd to herd by the apparently normal but infected female. The germs quickly die in the body of the bull and when once infected, he does not become a constant disseminator of the disease. Proper treatment will render him safe again as a sire.

CONTROL OF ABORTION DISEASE

In speaking of control, a distinction should be made between control and eradication. In the present state of our knowledge, we cannot truthfully say that the disease can be eradicated, but by methods to be later described it can be controlled to the point where losses are negligible and herd efficiency can be maintained.

It is natural, with such an obscure disease, that there should be great difference of opinion, especially regarding methods of control. Some believe that it is a hopeless proposition, but others, among them being some of the foremost veterinarians of our country, believe that by proper methods of herd management and attention to the principles of sanitation, it can be measurably controlled.

We have been groping about for cures, *but there is no cure*. At various times, drugs, such as carbolic acid, methylene blue and others have been advanced as cures, but after trial have been discarded as worthless. The nature of the disease is such that drugs can have very little effect upon it. Some have claimed to be able to prevent an abortion, where the case is taken in time, but whenever the disease has progressed to the point that symptoms are manifest, the conditions are such that the calf can no longer live within the diseased uterus and it must be expelled. We would not prevent it if we could, for to have the dead calf retained would endanger the life of the cow.

Vaccines are somewhat more promising, yet they are still in the experimental stage, and only extensive use can demonstrate their true value. In many of our contagious diseases, where the animal survives, an immunity remains, and man has been able to induce this immunity artificially through the use

of vaccines. In abortion disease, too, there is a decided tendency toward immunity, but our efforts toward developing a satisfactory vaccine have not been crowned with success. Our main reliance, therefore, must be placed upon preventive measures rather than drugs and vaccines.

In Kansas there are two distinct classes of cattle, differing widely in their habits of life and in the conditions under which they are kept, and while our methods must necessarily be different in handling the two classes, yet the fundamental principles are the same.

There is the dairy cow, living under unnatural conditions, often housed in most insanitary quarters and therefore subjected to all sorts of stable infections. She is under the double strain of nourishing a calf and at the same time producing a large flow of milk, consequently she has less resistance for throwing off disease. Yet the dairy cow has the advantage of being under the daily observation of the dairyman. Diseased animals can readily be separated from the herd; breeding can be absolutely controlled; and last but not least, she is milked twice or even three times a day, so when treatment becomes necessary she is docile and easily handled.

Contrast with the dairy cow the beef cow, living a comparatively free and natural life out of doors, not subjected to the stable infections, having but to produce her calf and suckle it until it can shift for itself, but having the disadvantage of being seldom seen as an individual by the stockman. Breeding cannot be satisfactorily controlled, and the animal is so wild that it is difficult and even dangerous to attempt to treat her. Because of these facts the disease is more severe and the after effects more serious in dairy cows. In beef cows complications are less frequent and recovery is more rapid and complete, although they are just as susceptible to the disease and the loss of calves is just as high.

Control of abortion disease is dependent upon three fundamental principles which may be outlined as follows.

CONTROL OF ABORTION DISEASE

(1) Prevent the dissemination of infection.

Isolate the aborting cow and destroy aborted calf and membranes.

Treat the aborting cow at once.

Control breeding.

Disinfect quarters.

Provide proper sanitary surroundings.

Follow proper methods of feeding.

(2) Develop herd immunity.

Retain aborting cows.

Raise calves.

Do not introduce new breeding females.

(3) Treat affected animals.

Erroneous ideas.

Flushing out genitals.

Removal of afterbirth.

Treatment for sterility.

(1) PREVENT THE DISSEMINATION OF, INFECTION

It is through methods of herd management that most can be accomplished in combating abortion disease.

ISOLATE THE ABORTING COW AND DESTROY THE DEAD CALF AND MEMBRANES

The dead calf and its membranes and accompanying discharges are teeming with the germs of the disease. They should be promptly gathered up and destroyed by burning, or buried deeply. The aborting cow continues to disseminate infection in her discharges for weeks, and far more disease is spread at this time than at any other. Consequently, isolation of the aborting cow is of the greatest importance in preventing the spread of the infection. The germs may be conveyed to susceptible cows in many ways where efforts are not put forth to limit the infection. For instance, in the dairy herd, a cow aborting in the line drops the infectious material in the stable; a careless attendant tramps through it, soiling his boots; he then walks up and down the feed alley or climbs into the silo, spreading infection wherever he goes. In the beef herd, on pasture or in the feed lot, the discharging cow contaminates the feed of the other cows. Quite often the aborting cow becomes a chronic "buller," and where the bull runs with the cows, as is commonly the case, he is continually transmitting the infection in an active form from the infected cow to the remainder of the herd.

TREAT THE ABORTING COW AT ONCE

Treat the diseased cow by flushing the genitals as hereinafter described. Immediately after abortion is the one best time for applying treatment, as the uterus closes within a few hours and cannot then be opened, except by an expert, without doing violence to the parts. Treatment is not only for the purpose of promoting recovery, but to prevent serious complications and avoid the dissemination of infection.

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CONTROL BREEDING

Do not permit the bull to serve any but perfectly healthy cows. Discharging cows and chronic "bullers" contaminate the bull, who in turn may carry the infection to others. Under no circumstances should such cows be permitted in the herd.

DISINFECT QUARTERS

Stalls or other quarters should be disinfected whenever contaminated, because of the danger of the transmission of the disease from the infected environment. Remove all manure and litter, thoroughly clean floor and walls and spray with compound cresol solution, one part to thirty parts of water i.e., a 3 percent solution. Any other good disinfectant may be used. Finish by whitewashing, the wash being made thin and applied as a spray. Whitewash itself is a good disinfectant, and it has the advantage of being easily seen, thus serving as an indicator to show the thoroughness of the work.

PROVIDE THE PROPER SANITARY SURROUNDINGS

Provide clean quarters, for where animals are kept under favorable conditions they thrive and amply repay for added care and attention. In combating contagious disease, sanitation is doubly important. Disease-producing germs live for a long time in dark, damp, filthy stables, and those same conditions are unfavorable for animals, lowering their vitality and resistance toward disease. Disease germs cannot long survive in clean quarters, well ventilated and flooded with sunshine.

FOLLOW PROPER METHODS OF FEEDING

The pregnant animal must nourish two, herself and the offspring, and certain elements which produce muscle and the bone must be supplied the cow if a vigorous calf is to be born. Starvation, the use of spoiled feed or feed containing certain poisonous principles may seriously affect reproduction, especially in the presence of infection. A varied diet, containing all the elements necessary for growth, must be supplied to the breeding herd to promote vitality and the power to resist disease. Bulletins on feeds and feeding may be had for the asking, and further discussion is unnecessary here.¹

The principles enumerated above, namely, quarantine and treatment of affected animals to limit infection, disinfection of quarters to destroy the infective agent, and sanitary surroundings and proper feed to promote health and resistance to disease, are used by sanitarians everywhere in combating disease, whether human or animal. In fact, success is seldom attained without employing them. *They constitute practically the only effective means we have for controlling abortion disease.*

(2) DEVELOP HERD IMMUNITY

Abortion disease is self-limiting. This fact has been repeatedly demonstrated in herds where there have been severe outbreaks attended by heavy losses. Where the owners did not become panic stricken and dispose of their herds, the disease has often subsided as rapidly as it began, and the herds have afterward gone on reproducing with only slight loss. This happy result came about through the development of immunity in the individual animals. Investigation has shown that approximately two-thirds of the cows that abort, lose their calves but once where properly treated, and thereafter they become immune. About one-third abort a second time, and only a small percent a third time. It is true that in such herds the disease may continue to manifest itself for some time by an occasional abortion, a retained afterbirth, or a case of sterility, but practically the disease may be said to be under control.

1. Write to the Agricultural Experiment Station, Manhattan, Kan., for information.

RETAIN ABORTING COWS

Because of this tendency to become immune, the cow that has aborted and through proper treatment has been restored to health, should be retained. She is more valuable in the infected herd than a new cow, which in turn might contract the disease. Many a fine cow has been sacrificed because of the mistaken idea that abortion can be controlled by disposing of affected animals. Never sell a valuable breeding animal, whether cow or bull, because of abortion disease. Unprofitable and hopelessly sterile cows should be weeded out on general principles, for they require attention that should be bestowed upon the good ones. But these cows should go to slaughter. Too often they are sold into other herds, without the new owner being aware that they are diseased. This practice of surreptitiously selling diseased animals has spread this and other diseases, far and wide, and it cannot be too strongly condemned.

RAISE FEMALE CALVES

The vigorous heifer calves which reach maturity in spite of the disease are naturally from the more resistant cows and they seem to inherit this tolerance, consequently they are less apt to abort in turn than cows from other sources. Raise them. They will aid in building up a herd immunity. Herd improvement can also be secured through the use of purebred sires.

DO NOT INTRODUCE NEW BREEDING FEMALES

Do not introduce new breeding cows into the herd if possible to do without them. Abortion disease persists indefinitely in a herd where cows are constantly being bought and sold. The new cow may be either infected and a spreader of disease, or free and susceptible to it. In the former case she introduces new infection, and the owner has gained nothing by exchanging aborters; in the latter, a new victim has been added to the herd. Abortion disease may be likened to a fire, which, if new fuel is not constantly added, soon dies down. Herd immunity is developed, therefore, by retaining the immune cows, raising the calves, and avoiding the introduction of foreign cattle.

The foregoing practices have been found effective in preventing dissemination of infection and developing immunity to abortion disease in dairy herds.

PREVENTING DISSEMINATION OF INFECTION AND DEVELOPING IMMUNITY OF THE BEEF HERD

Nearly all of the investigational work in connection with abortion disease has been conducted with dairy cattle. It has been pointed out how dissimilar are the habits of living of beef and dairy cattle. The methods of controlling abortion disease in the one must therefore differ from the other in detail if not in principle. To bring relief to the stricken beef herds of Kansas, methods must be adapted to their conditions. The following plan is therefore proposed:

The cows are customarily bred to calve in the spring, the bull being put with the herd the latter part of May. A few months will suffice for breeding the herd, and the bull should then be removed. Abortions usually occur at from five to eight months of pregnancy, so most of them will take place after the cattle have gone to the feeding grounds in the fall. There the cattle are usually under the daily observation of the owner, and they can be closely watched for evidences of abortion. All cows threatening abortion and all aborters should be promptly removed to a separate enclosure and appropriate treatment given. Destroy the aborted calf, membranes, and discharges as they are particularly dangerous. The removal of the aborters limits dissemination of infection

through the contamination of the feed. No aborter or cow with a discharge should be permitted to rejoin the herd until all discharge has ceased and recovery is complete. By this method all the cows that are to abort will have aborted and been cleaned up before time to go out on pasture the following spring, and no discharging cow or chronic "buller" should be permitted in the herd to contaminate the bulls.

As a result, infection is reduced in amount and virulence; susceptible animals become immune; the outbreak subsides and reproduction approaches its normal level. It will be observed that the same fundamental principles apply here as in the dairy herd. Infection is limited through control of breeding and isolation of aborters; treatment is given to avoid complications and preserve the reproductive function; and a herd immunity is developed by retaining immune cows and raising calves. This plan interferes as little as any yet proposed with present herd practice, in fact takes advantage of it, and any owner who will persistently follow the practices outlined heretofore should get results.

It is realized that it would be impossible to devise a plan suited to all sections and all conditions. The control of range abortion is so difficult because of the conditions already described. Nevertheless this fact does not change the nature of the disease, and *he who would suppress it must exert every effort to make his methods conform to its requirements.*

(3) TREATMENT OF AFFECTED ANIMALS

ERRONEOUS IDEAS

The Use of Vaccines, Bacterins, Etc.—The ideal method to control contagious abortion, reasoning from analogous treatment in other contagious diseases, would be by vaccination, and many such agents are on the market under the name of vaccine, bacterin, abortin, etc. The manufacturers claim excellent results from the use of their products. Some go so far as to issue a guarantee to cure the disease or refund the money. In spite of this, careful unbiased investigators accord but a very low immunizing value to these agents. They have acquired somewhat of a reputation among some cattlemen because the disease apparently abated materially following their use. But abortion being in a measure a self-limiting disease, the vaccines simply received credit for a result that would have taken place without their use. No responsible person claims that vaccination is not along approved lines of treatment in the handling of contagious and infectious diseases. But the chronic nature of contagious abortion and the low natural immunity following an outbreak indicate that by our present methods we cannot hope to establish a satisfactory artificial immunity.

The Use of Carbolic Acid.—Carbolic acid administered in various ways, such as in the feed, with salt, or injected under the skin, has probably acquired a greater reputation as a drug valuable for the control of contagious abortion than any other agent. The chief reason for this is because as a rule no treatment is attempted until the disease has reached its maximum, and in the natural course of events there is a great reduction in the slinking of calves the following year. It is during the height of the disease that the use of carbolic acid is instituted, and it receives credit for the natural decrease in the number of aborted calves. The fact that abortion has increased, in spite of the use of carbolic acid for many years, is an indication that it is not a specific, and is of very questionable value.

The Use of Methylene Blue.—This is an anilin dye, claimed to have antiseptic properties, and to have specific action in contagious abortion. It was extensively used a few years ago for this purpose and inquiries are still received regarding it. Its value as an agent for the cure or control of contagious abortion was greatly overestimated, and it has almost fallen into disuse for that purpose.

FLUSHING OUT THE GENITALS

Flushing Out the Female Genitals.—By this is meant the washing out of the uterus by introducing various liquids, especially disinfectant washes, which process mechanically removes a large amount of decomposing and putrid material. If properly performed it is undoubtedly of great value, though there are many limitations. For instance, it is recognized that it is impossible to absolutely disinfect such a large infected cavity as the uterus by any means now at our disposal. But we can by applying disinfectants reduce the vitality of all germs, and especially those causing ordinary infection, and thus control the infection so that nature will have an opportunity to effect a cure. Strong disinfectant washes should never be introduced into the uterus, as they have a certain corroding influence. When too strong they do more harm than good. Likewise, weak disinfectants should be immediately withdrawn, because if retained in the uterus they have the same though slower, corroding effect, and in addition, being poisonous, they may be absorbed from the raw interior of the uterus and produce poisoning.

A general knowledge of the anatomy of the parts is absolutely essential to treatment. The opening into the genitals is spoken of as the vulva, and is succeeded by a large cavity known as the vagina. In the front portion of this is the neck of the uterus. This latter structure varies greatly, depending upon the pregnant or non-pregnant state of the animal, the nearness to parturition, the length of time after parturition, and whether the afterbirth is retained or discharged.

There is a popular misconception regarding the neck of the cow's uterus, largely because many livestock men have had occasion at some time or other to examine this organ in the mare, and believe the anatomy to be the same in the two animals. This is wrong, for while the neck of the uterus in the mare is soft, straight and usually more or less open so that a finger may readily be passed through it, in the cow it is rigid or hard, tortuous, and in its normal state impervious to the finger. These latter facts have many times caused a cattle owner to believe that his animal is barren because she is not "open."

In the pregnant state, the neck of the uterus is closed and sealed with a plug of mucus. In the healthy non-pregnant animal it is likewise impervious, though there is no plug of mucus. Immediately preceding and during calving, the "neck" is widely dilated or practically disappears, but it will again contract to its non-pregnant state shortly after the act of calving is completed. However, if the afterbirth does not come away but hangs out through the "neck" it will keep the latter open, while on the other hand, if the afterbirth is retained entirely within the cavity of the uterus, the "neck" will close and imprison the decomposing afterbirth.

The question of washing out the uterus depends entirely upon the ability of the operator to overcome all these difficulties. As long as the "neck" is open, the procedure is a simple one, becoming increasingly difficult as the "neck" closes, or the afterbirth is retained.

Immediately after the abortion the uterus may be washed out with from a few pints to several gallons of lukewarm disinfectant solution. The amount used varies, as a rule much less being needed when there is but little infection and when the abortion has taken place at an early period, because at this time the uterine cavity is much smaller than at a later period. The general rule is that the washing out is to be continued until the solution comes away clear.

The following disinfectants may be used: (1) A one-half of 1 percent water solution of carbolic acid, which for practical purposes may be made by adding a teaspoonful of carbolic acid to one quart of water. (2) A one-fourth of 1 percent water solution of compound solution of cresol, being one teaspoonful to one-half gallon of water. (3) In some instances, especially immediately after calving or abortion, even such weak solutions as (1) and (2) cause the animal to strain violently. In that case it is

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probably better to use (for a few days) a salt water solution made by adding salt to tepid water in the proportion of a smooth teaspoonful of salt to a pint of water.

The solution is best introduced by means of a piece of soft rubber tubing passed through the neck of the uterus, and as far forward into the uterus as possible, attaching a funnel to the free end of the tubing, elevating the latter three or four feet and permitting the solution to enter by gravity. The use of an injecting pump is not advisable, as by means of the latter too much force is at times exerted, resulting in rupture of the uterus and death of the cow. As the uterus becomes filled the solution may be withdrawn simply by lowering and inverting the end of the tube and attached funnel, so that it acts as a siphon. During this process there is a tendency for uterine folds, afterbirth, and shreds of membranes to be drawn into the tube so that the latter must be kept free by means of the hand inserted into the uterus alongside the tube. If the solution cannot be so removed, it then becomes necessary to insert the hand and arm into the animal's rectum, with the palm of the hand downward, and then by stroking the uterus from before backward, the solution may be massaged out.

The number of washings also vary greatly. If the infection is slight, as indicated by little or no discharge, one washing may be sufficient; if there is much discharge, the washing should be repeated daily, gradually reducing them as the discharge decreases.

In all of this work it is of prime importance that the strictest cleanliness be observed. Under no circumstances is it permissible to insert filthy hands, or introduce dirty instruments into the genitals. Likewise before commencing the operation the outside genitals must be cleansed by washing with soap and water, followed by an antiseptic such as previously recommended.

Flushing Out the Male Genitals.—The long hairs at the opening of the sheath should be kept clipped as short as possible. An area, having a diameter of about 2 feet immediately surrounding the opening of the sheath should be thoroughly scrubbed with soap and water, followed by a 2 percent solution of some good hog dip or other reliable disinfectant. The interior of the sheath may be disinfected with the same class of agents as previously recommended for flushing out the uterus of the cow. The same form of apparatus may be used for irrigating purposes, i.e., a piece of rubber tubing and funnel, or a human fountain syringe is very serviceable. The disinfectant is permitted to flow into the sheath by gravity until that organ is distended with the solution. Outflow is momentarily prevented by grasping the opening of the sheath in one hand, and at the same time manipulating the sheath with the other, so as to cause the disinfectant to permeate all parts of the structure. By thus alternately filling up and emptying the sheath, and repeating the process before and after each service the spreading of abortion by the bull will be practically eliminated.

REMOVAL OF THE AFTERBIRTH

If abortion occurs during an early stage of pregnancy, the afterbirth is usually passed out with the young. At a later stage it is almost invariably retained, and in those herds in which contagious abortion is present, but in which the calves are carried full term, retention of the afterbirth is frequently the only symptom. When this failure to promptly pass the afterbirth is observed in several members of a herd, it is almost conclusive evidence that the disease commonly spoken of as "**contagious abortion**" is present.

It is almost a physical impossibility to completely and thoroughly remove the retained afterbirth of contagious abortion, and many good animals have been ruined by attempts to do so. In the cow the afterbirth is usually held tightly in that portion of the uterus closest to the

ovaries, and this is beyond the reach of the longest armed operator. The result of an attempt at removal is that most of the afterbirth, with the exception of that in the inaccessible part of the uterus, is removed, and this remnant, through decomposition, causes a chronic discharge. The diseased condition thus produced causes a thickening of the walls of the uterus, and possibly hopeless barrenness.

In the present state of our knowledge the best that can be done with a retained afterbirth is to keep the outside genitals as clean as possible with antiseptic washes, to wash out the vagina daily with an antiseptic wash so as to remove accumulated decomposing material, and to insert into the uterus a gelatin capsule, having a capacity of approximately 1 ounce, filled with iodoform. The capsule will dissolve so that the practically non-irritating though powerfully disinfecting iodoform will be in contact with the afterbirth so as to prevent the formation of bacterial poisons and the resultant septicemia or so-called blood poisoning. Instead of a capsule containing iodoform, a mixture of 1 pint of olive oil and 1 ounce of iodoform may be used, being introduced by means of a funnel and rubber tubing. Cottonseed oil, and mineral oil may be used as cheap and efficient substitutes for olive oil. One of the foregoing antiseptics should be used as often as twice a week as long as the afterbirth is retained.

Regarding the afterbirth itself, it is to be pulled on gently by grasping it with the hand in the vagina and as close to the neck of the uterus as possible, and it is to be removed only when it comes away easily. It may be necessary to repeat these manipulations daily for several days; patience and perseverance, combined with the skill of experience, will bring the best results. Under no circumstances should force be used, nor should a portion of the afterbirth be removed, because, as stated heretofore, as soon as the afterbirth no longer hangs through the neck of the uterus the latter will close and imprison the remaining portion so that it cannot be removed, but must be slowly absorbed, leaving the animal's health permanently ruined and her breeding power destroyed.

It is not the idea to convey the impression that ideal results will be obtained from the foregoing treatment. If properly carried out, though it requires severe and exacting labor, it will give better results than any other line of treatment practiced at the present time.

TREATMENT FOR STERILITY

Sterility or barrenness is a condition in which the cow fails to conceive though bred repeatedly. It is a common sequel of contagious abortion as either the abortion germ or the germs that enter the uterus as a result of retained afterbirth are capable of maintaining the uterus in a serious state of ill health. Other conditions, in addition to infection of the genitals, that are responsible for barrenness are diseased ovaries and occasionally disease of some other part of the female genitals. The handling of these conditions demands an intimate knowledge of anatomy and pathology, and vast experience. The novice, and even the expert, is bound in some cases to be disappointed in the results obtained.

If a cow's afterbirth is promptly discharged, or if retained the infection that accompanies it is controlled by the methods outlined in the preceding pages, then barrenness from that source will be reduced to a minimum. In this connection it is well to remember that in some cases a portion of the afterbirth is retained, or the infection is so severe that at the end of four to six weeks of treatment no improvement is observed. In such cases the animals should be slaughtered as incurable and as a menace to the remainder of the herd.

There are many erroneous ideas about barrenness. The commonest being that the animal is not open. It is well to repeat what has been stated in previous pages, that in a state of health the neck of the uterus in a cow, contrary to that of the mare, is impervious to the passage of a

finger or even an object much smaller than a finger, and an attempt to "open" a cow in order to make her conceive is bound to result in failure or may end in the death of the animal. Likewise breeding powders and similar preparations or concoctions administered by way of the mouth, injected into the genitals, or given in any other manner will not overcome the diseased condition of the genitals, which is largely responsible for the barrenness. In case of valuable animals, consult a graduate veterinarian, experienced in this work. Let him make an examination and render an accurate diagnosis upon which intelligent treatment may be based.

It should be understood that no hard and fast rule for handling abortion disease can be laid down. Each herd is a study in itself and treatment must vary with the conditions. *A man who will not follow a definite plan of herd improvement need expect no help, for no help can be given.* There is no easy way of getting rid of this disease. Its suppression is dependent upon a realization on the part of the owner of the principles underlying disease, and the thoroughness with which he carries out the details of sanitation.

CONCLUDING STATEMENT

Much remains to be discovered concerning abortion disease, and many points are still in controversy, but enough is known to make its control possible. It has been the purpose of the authors, without entering into controversy, to make the information we now have available for the use of the cattle owners. The Kansas Agricultural Experiment Station stands ready to aid in combating this disease to the full extent of its resources. Many problems of both scientific and practical nature still await solution, problems that can only be solved through prolonged and expensive experimentation. The cattle owner himself can be of great assistance in offering his herds for working out details, and success will depend largely upon his hearty cooperation. The opportunity and necessity for extensive work in controlling abortion disease in Kansas is very plain, and it is hoped that funds can be found for conducting comprehensive investigations.

SUMMARY

1. Abortion disease is one of the most destructive of all cattle diseases and should receive most careful attention from both beef cattlemen and dairymen.

2. This is a contagious disease, therefore due to a specific germ rather than accident.

3. It not only causes the death and expulsion of the immature calf, but manifests itself by retained afterbirth and sterility as well.

4. It is spread throughout the herd by the bull and by contamination of feed, and from herd to herd by the purchase of diseased cattle.

5. There is no cure for the disease. Drugs, such as carbolic acid and methylene blue have proved valueless, while vaccines are still in the experimental stage.

6. Abortion disease can be controlled by proper methods of herd management. Control is dependent upon three fundamental principles: (1) Preventing the spread of infection. (2) Developing herd immunity. (3) Treating affected animals to promote recovery and preserve the reproductive function.

7. Treatment of aborted cows and of retained afterbirth and sterility requires special knowledge and skill. Therefore, a graduate veterinarian should be employed if possible.

8. Abortion disease is self-limiting, and will die down of itself if the breeding herd is kept intact.

9. Never sacrifice valuable breeding animals because of this disease; retain and treat the aborters, and raise the normal calves to replenish the herd.

10. Results in combating abortion disease depend upon the establishment of definite plans of herd improvement and careful attention to the details of sanitation and preventive medicine.

