

Specific Infectious Diseases that Limit Bovine Reproduction

Howard L. Whitmore, D.V.M., Ph.D.
College of Veterinary Medicine
University of Illinois
Urbana, Illinois

Summary

An attempt was made to rank diseases that lower conception rate in cattle. These diseases are: 1) postpartum metritis resulting in problem breeders, 2) "unknown viruses" that cause early embryonic death, 3) campylobacteriosis, and 4) trichomoniasis. An attempt was also made to rank specific diseases that cause abortion. These diseases are: 1) "unknown viruses" probably make up a large part of the 70 to 80% of non-diagnosed abortions, 2) leptospirosis, 3) BVD, IBR and Blue Tongue viruses, and 4) brucellosis, and 5) fungi.

Evidence was presented to show that *L. hardjo* does not lower conception rate. Evaluation of dairymen's records suggests that conception rate drops during the acute phase of ureaplasma granular-vulvitis. Controlled trials using experimental inoculation of ureaplasma, mycoplasma, and chlamydia organisms at the time of breeding are needed to more clearly define the role of these organisms on conception rate.

Introduction

The purpose of this paper is to present a brief overview of the major infectious diseases that limit reproduction in dairy cattle. In addition, a more detailed discussion of 4 reproductive diseases causing much concern among dairymen and practitioners will be presented. These 4 reproductive diseases are leptospirosis, ureaplasma, mycoplasma, and chlamydia.

It is generally believed that most infectious organisms are shed in the semen of bulls.¹ Thus research on the effects of any specific organism on reproduction should include direct infection of the uterus (such as the use of contaminated semen processed for artificial insemination). This may have no effect or cause fertilization failure or death of the early embryo. In addition, experimental infection by natural routes (oral or nasal) at the time of breeding or during pregnancy needs to be studied.

One method of looking at specific diseases that limit reproduction is to try to rank them by order of importance. This is not an easy task. It is surprising how few infectious diseases have been shown to cause repeat-breeding or early embryonic death. The list of organisms that cause mid- or

late-term abortion is much longer.

The most important reproductive tract infection that dairymen and practitioners must deal with is infection of the uterus following calving. Much of this infection is related to retained fetal membranes and dystocia. However, many cows require treatment following calving and it is clear that many severe cases often become "problem breeders." The average dairyman might expect to have 8-10% prevalence of dystocia plus a 10-15% incidence of retained fetal membranes. This usually means that 10-20% of all cows may have chronic metritis that requires some form of treatment. Thus, this reproductive disease complex is much more important than any other infection we could list.

The second most common cause of problem breeders may be a large group of "unknown" viruses. Certain dairy herds experience a 10-20% outbreak of early embryonic death. A complete diagnostic workup rules out the few known causes of early embryonic death and appears to suggest an "unknown virus" is involved. The effect of most viruses on conception and embryonic death has not been studied. There is only very limited evidence that BVD virus may cause repeat breeders if present in semen used for artificial insemination.² Oral inoculation of BVD virus at the time of breeding had no effect on conception rate compared to controls.

A good way to study the effect of viruses on conception is to mix viruses with semen and inseminate cows, or infect them by natural routes at the time of breeding. Experimental infection of cattle at different stages of pregnancy is a good way to study early embryonic death and abortion. Much more of this work using adequate control animals needs to be done.

The two most well known single diseases causing repeat breeding and early embryonic death are campylobacteriosis and trichomoniasis. These are both true venereal diseases and they serve as good models to learn more about venereal disease. The number of venereal diseases is increasing. It is now believed that all systemic infections result in shedding of organisms in the semen.¹ Contaminated semen used for artificial insemination presents new problems. The cervix is a good barrier for preventing entrance of some organisms into the uterus. However, use of artificial insemination

bypasses the cervix and contaminated semen may be deposited directly into the uterus. It is also possible that organisms comprising the vulvo-vaginal flora may be picked up by the AI pipette and introduced into the uterus. It should be stated, however, that although it is possible for most organisms to be shed in semen, the majority of evidence shows that this rarely occurs.

Ranking specific diseases that cause abortion in cattle is also difficult. Many comprehensive reviews on diagnosis of abortion show that 70 to 80% of the causes of abortion are "unknown." Personal experience with complete diagnostic workups from approximately 100 dairy herds undergoing "abortion storms" suggests that unknown viruses are the most important cause of abortion. This included examination of the feed for "estrogen-like" substances and mycotoxins. The so-called abortion storm results in 5-15% of the herd aborting over a 4- to 8-month period. Research efforts to identify these unknown causes of abortion storms must continue.

It is somewhat easier to document abortion than early embryonic death. Four specific agents that clearly cause abortion include leptospirosis, BVD and IBR viruses, and brucellosis. These are the 4 diseases that practitioners should conduct serological tests for in all cases of abortion storms. Other tests should be conducted on the fetus at state diagnostic laboratories (i.e., fungus, miscellaneous bacteria, chlamydia, etc.). If practitioners rule out the above 4 diseases (based on serology) and the diagnostic lab findings are negative, then I believe it is safe to tell the dairymen that the abortion storm is probably caused by an unknown virus and that the typical abortion storm stops at about the 5-15% level. Our obligation is to test for any known contagious organism and vaccinate the herd if necessary. Many more viruses need to be tested at various stages of pregnancy in order to document their pathogenicity for the placenta and the fetus.

Leptospirosis

It is clear that several serovars of *leptospira interrogans* have been shown to cause fetal death, abortion, stillbirths, and the birth of weak calves.³ Veterinary practitioners are concerned about the possibility of lepto causing reduced conception rates in cattle. The Committee on Leptospirosis for USAHA has stated: "In about one-third of the states, *L. hardjo* was considered to be a common cause of infertility in cattle." However, experimental evidence incriminating this organism is lacking. In recent years the prevalence of seropositive cases of *L. harjo*, is increasing and frequently surpasses that of *L. pomona*. It has been shown that leptospiras, including serovar *hardjo*, survives semen processing, freezing, and storage.⁴ Therefore, genital transmission is possible in both naturally bred and inseminated animals.

A study was recently performed to determine the effect of *L. hardjo* on fertility in cattle.⁵ Twenty sero-negative mature

dairy cows were assigned to 2 groups. Group 1 challenge cows were bred by a sero-negative bull, followed by intrauterine infusion (within 30 minutes) of 5×10^9 *L. harjo* organisms. Group 2 cows were bred by the same bull, followed by intrauterine infusion of 5 ml of sterile culture media. Blood samples were collected at 2-day intervals to monitor serum antibody titers. Cows were slaughtered 35 days postbreeding and their reproductive tracts were examined. All animals remained clinically normal following infection. The results showed that 7 of 10 cows were pregnant in the infected group and 6 of 10 cows were pregnant in the control group at the time of breeding. All embryos and reproductive tracts appeared normal. All infected cows developed serum antibodies to *L. hardjo*, while control cows remained negative.

Thus, it appear that although *L. hardjo* causes mid- to late-term abortion in cattle, it probably does not cause repeat breeding or very early embryonic death. Additional studies on the effect of other serotypes of lepto on conception are needed.

Ureaplasma

Ureaplasma has been isolated from field cases of bovine granular vulvitis, endometritis, abortion, and seminal vesiculitis. The primary reproductive tract disease caused by ureaplasma appears to be an acute granular vulvitis. Doig and Ruhnke and coworkers investigated herds in Canada that were having repeat breeder problems, mucopurulent vulvar discharge, and granular vulvitis.⁶ Ureaplasma was isolated from 100% of cows with acute granular vulvitis, 74% of chronic cases of vulvitis, and 24% of normal cows within each herd. These workers reported a drop in fertility during the acute phase of the vulvitis. They speculated that during the insemination process, organisms were picked up from the vulva and introduced into the uterus. In a number of herds first-service conception rates dropped below 30% for several months. An increase in fertility was associated with intrauterine infusion of 1 gram of oxytetracycline.

The acute form of granular vulvitis has been described by observing hyperemia, granularity, and intermittent mucopurulent vulvar discharge following experimental inoculation.⁶ There was much variation in clinical signs of vulvitis among animals and in duration of signs. The chronic form of the disease was even more variable and difficult to diagnose.

In most cases, however, the clinical severity of granular vulvitis does not correlate well with subsequent fertility. Thus, the role of ureaplasma as a cause of reduced fertility remains very controversial. It appears that the next logical step in the study of ureaplasma infection would be to infuse the organisms directly into the uterus at the time of insemination and to determine its effect on conception under controlled conditions.

Practitioners should realize that ureaplasma organisms are often found in the genital tract of both fertile and infertile cattle. They should be considered opportunists. They

apparently cause some degree of vulvitis when first introduced into the vulva. More control trials are needed to determine if ureaplasma causes reduced fertility in cattle.

Mycoplasma

Mycoplasmas have a predilection for mucosal surfaces of the respiratory tract, urogenital system, the mammary gland, joints, and eyes. Some are considered part of the normal flora. *M. bovis* is very pathogenic causing mastitis, polyarthritis, and some pneumonia in cattle. This species rarely causes genital tract infection. *M. bovis genitalium* is the most frequently isolated mycoplasma and is believed to cause a wide range of reproductive problems (i.e., granular vulvitis, endometritis, infertility, abortion, and seminal vesiculitis syndrome). Experimental reproduction of these conditions has resulted in both success and failure. Thus the role of mycoplasma as a cause of reproductive problems remains controversial.⁷

M. bovis genitalium is a common contaminant in semen. The organism survived both freezing and thawing. There is only very limited evidence that contaminated semen used for artificial insemination causes disease. However, there is more concern that contaminated semen has reduced motility and survival after freezing and thawing process.⁷ Thus, artificial insemination organizations are monitoring semen for mycoplasmas and determining which antibiotics, when added to semen, will control these organisms. Work is underway to develop a bacterin for *M. bovis genitalium* and preliminary results are encouraging.

Chlamydia

The natural habitat of chlamydiae is the intestinal tract. Up to 60% of the animals in a herd may have enteric infection. Some of the enteric isolates have been shown to cause experimental abortion in cattle.⁸

The primary diseases caused by chlamydia are abortion in sheep and cattle. Polyarthritis in lambs and calves may also be due to chlamydia infection. Abortions in cattle occur primarily in the last trimester. Experimental inoculation of pregnant cattle causes an increase in temperature 2-4 days later and abortion 21-24 days later. The incidence of abortion within a herd is usually quite low (1-5%).

It is clear that chlamydia caused natural and experimental reproductive tract infection in bulls. The role of chlamydia in repeat breeding and early embryonic death is not known.

Diagnosis of chlamydia is by isolation of the organism on embryonated eggs or tissue culture.⁷ A four-fold rise in antibody titer in samples based on complement fixation test is also diagnostic. A rapid diagnosis of abortion can sometimes be accomplished by identifying elementary bodies and the Gimenez stained impression smears from infected placenta. More diagnostic laboratories are becoming equipped to culture or conduct antibody test chlamydia.

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