Advances in the Diagnosis of Infectious Bovine Abortion

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Introduction

There has been an increased understanding of bovine abortion and the causes over the past few years. The reasons for this understanding are attributed to better recognition of the problem itself, the potential causes of the problem, and finally, how diagnostic assistance can be of value in determining the cause or causes of the problem we collectively refer to as abortion.

Recognition of the problem. Bovine abortion has been defined as the termination of pregnancy before the fetus is vialbe (4). Abortion results from the premature initiation of parturition when normal fetal-maternal relationships are interrupted. Parturition is normally initiated by the fetal pituitary adrenal axis (3). Effective control of the pregnant uterus by the fetus is lost at the time fetal death occurs. Although many factors have been associated with premature expulsion of a nonviable fetus, the actual mechanism whereby infectious abortion occurs has never been adequately explained (4). Although abortion can occur anytime during gestation most are observed during the second half. Apparently, the majority of abortions that occur during the first half of pregnancy are not noticed and the cow is usually treated clinically for infertility (3).

Since the cause of bovine abortion is only diagnosed in 30% of all cases (3,16) there is an immediate need to determine the factors involved for at least three seasons. These include: (i) if the cause of the abortion is found to be an infectious agent (bacterial, chlamydial, mycotic, or viral), an immunization program could be initiated if a vaccine were available; (ii) if no vaccine were available, appropriate management of livestock could be instituted in order to control the problem in succeeding years; and (iii) to determine if more than one factor was involved, such as inadequate nutrition together with an infectious agent.

Recognition of potential causes of the problem. The causes of abortion can be divided into noninfectious and infectious. Examples of noninfectious abortion include those resulting from trauma, drug-induction, plant toxicity, and nutritional deficiencies/toxicities. However, each abortion should be regarded as being infectious to other pregnant animals until proven otherwise (4). The infectious agents known to be associated with bovine abortion cover a wide range from bacteria to viruses (Table 1). The major infectious agents known to cause abortion have been recently reviewed (3). In addition to these microorganisms, ureaplasma and *Haemophilus somnus* have also been implicated as causal agents in bovine abortion (5,15). Recently the emergency of a new bovine herpes virus referred to as "non-IBR herpesvirus" (bovine herpesvirus type 4, Movar 33/63, DN-599) has indicated that yet another virus may be recognized as a cause of bovine reproductive problems (12,20).

Diagnostic assistance to determine the cause of the problem. Although animal nutrition and reproductive soundness are essential for the overall reproductive health of the cow and her offspring (19), infectious agents are ever-present and require constant monitoring. Diagnostic laboratories are especially suited to determine the presence of

Table 1. Infectious Causes of Bovine Abortion

Bacterial	Viral
Brucellosis	Infectious bovine rhinotracheitis (IBR) virus
Leptospirosis	Bovine viral diarrhea (BVD) virus
Vibriosis	Parainfluenza type (PI-3) virus
Haemophilus	Bovine herpesvirus type 4**
Ureaplasma*	Bluetongue virus
Chlamydial	
Fungal	
Protozoan	

*formerly called T-strain mycoplasma

**also referred to as non-IBR herpesvirus

***antigenically related to equine herpesvirus type I (equine rhinopneumonitis virus)

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infectious agents either by direct isolation of the causative organism, by serologic detection of antibody titer changes, or by pathologic (gross and histologic) lesions.

In an effort to assist in the diagnosis of infectious bovine abortion, the Washington Animal Disease Diagnostic Laboratory assembled an abortion diagnosis kit. The kit was designed after one used at Cornell University for the diagnosis of bacterial abortions. The present kit includes all the materials necessary to collect and transport samples to the laboratory. Table 2 lists the the samples to collect, which includes: bacteriology; virology; serology; and histopathology. This multi-diagnostic approach to determine the cause of reproductive problems is necessary since abortion represents only one aspect of the complex referred to as the fetal-neonatal mortality syndrome (3).

This report summarizes the current status of non-IBR herpesvirus in bovine reproductive problems.

Materials and Methods

The procedures utilized for the isolation and identification of the viruses described herein have been previously described (7,8). Briefly, primary bovine testicular cells were maintained in cell culture with Earles minimum essential medium supplemented with 10% heat-inactivated fetal bovine serum (free of BVD virus and BVD virus antibody), and 50 μg/ml gentamicin.

The viral isolates were identified as herpesviruses on the basis of their nuclear inclusion body formation, chloroform sensitivity, and indirect nucleic acid determination

Table 2. Abortion Diagnosis Kit

Bacteriology;	Lung	
	Liver	Whirl top bag marked "BAC"
	Placenta	Separate bag marked "PLA"
	Fetal stomach contents	Red top tube
	Cervical mucous	Amies medium Thiol medium Al tube
Vorology:	Lung	
	Liver	Whirl top bag marked "VIR"
	Placenta	
	Cervical mucous	VID** vial
Serology:	Fetal heart blood or fetal thoracic fluid	Red top tube
	Dam's sera at time of abortion & 10-14 days later	Red top tube
Histopathology:	Lung	
	Liver	Buffered formalin jar
	Placenta	
	Adrenal	

*Samples should be transported to laboratory in a styrofoam container with ice packs.
**Virus isolation diluent.

indicating that the viruses contained DNA. The viruses were not neutralized by specific antibody to bovine herpesvirus type 1 (IBR virus).

Results

During the period 1979 through 1981, there were 23 non-IBR herpesviruses isolated. The disease conditions from which these viruses were isolated are presented in Table 3. The highest percentage (47%) of isolates came from respiratory cases, followed by 35% from enteric problems and 18% from reproductive disorders. Metritis and abortions both accounted for 9% of the total isolates.

A summary of the two abortion cases from which non-IBR herpesvirus were isolated is presented in Table 4. The first case (WSU 79-6083) occurred during the last trimester while the second case (WSU 79-6749) occurred during the second trimester. Both cases were observed in Holstein cows. In one case (WSU 79-6083), BVD virus was also isolated indicating at least a dual infection of the fetus had occurred.

Table 3. Non-IBR Herpesviruses Isolated from Cattle in the Northwest United States

Disease Condition	Number of Observations	Percentage of Observations
Respiratory		
Rhinitis/nasal discharge	4	17
Pneumonia	7	30
Enteric		
Neonatal scours	3	13
Diarrhea (>2 weeks)	5	22
Reproductive		
Metritis	2	9
Abortion	2	9
TOTAL	23*	100

*5 cases had a dual infection with BVD virus.

Discussion

The isolation of non-IBR herpesviruses from bovine reproductive disorders substantiates earlier reports (2,20) and further indicates the necessity to study this group of viruses (12) and its role in bovine metritis and abortion.

The results observed in this study indicated that the non-IBR herpesviruses have a disease spectrum almost as diverse as IBR virus (9,11). Recent reports have shown that this group of viruses also has a latent state similar to IBR virus (13,17).

Although there are at least fourteen different viruses known to infect the bovine fetus (14), IBR virus is generally considered to be the most abortifacient (11). Following IBR virus, BVD virus is the second most common agent associated with bovine reproductive problems (10). The potential interactions of BVD virus with the non-IBR herpesviruses needs to be studied further in light of the case described herein (WSU 79-6083), and the previous report citing a dual

Table 4. Non-IBR Herpesviruses Isolated from Bovine Abortion

Case No.*	Samples	Breed	Ranch Location
WSU 79-6083**	8 mos. fetus	Holstein	Brady, WA
WSU 79-6749	5 mos. fetus	Holstein	Burlington, WA

*Washington Animal Disease Diagnostic Laboratory case number
**BVD virus was also detected

infection by these two viruses (20). Parainfluenza type 3 virus infection is also a factor in bovine abortion (6,7), however, the results from this laboratory (not shown) have indicated that this association is primarily based on fetal antibody titers to PI-3 virus rather than direct virus isolation.

Other than IBR virus, the majority of viruses known to affect the bovine fetus (14) may result in a congenital infection with subsequent survival of the fetus to the calfhood state. The mechanisms of viral infection of the bovine fetus and possible outcomes is presented in Figure 1. Although congenital defects are defined as being present at birth, many defects may not be identifiable until later in life (18). In fact, some congenital defects are not identifiable without clinical, biochemical or pathological examination. There is increasing awareness of the diagnostic importance of syndromes consisting of a combination of various structural defects or the association of functional and structural defects (18).

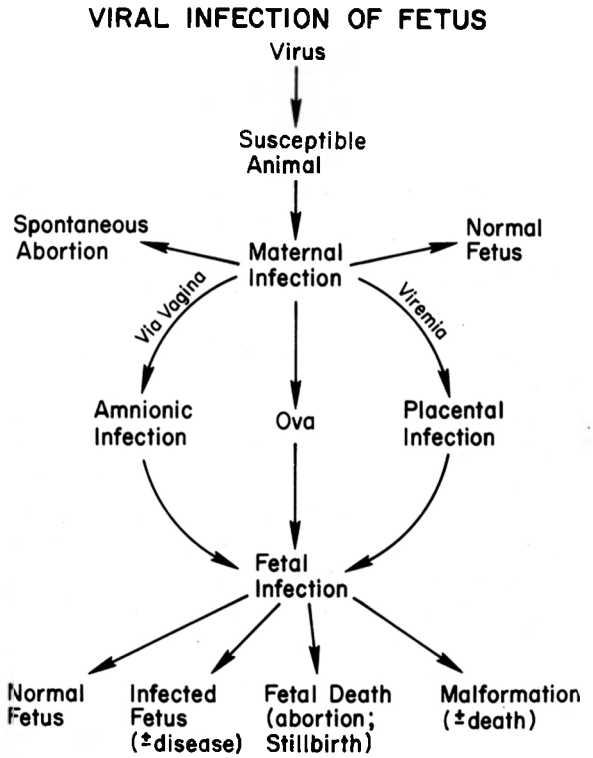

Figure 1. Mechanisms of Viral Infection of the Bovine Fetus and Possible Outcomes Modified from Catalano, Jr. and Sever (1)

The goal of the diagnostic laboratory should be to aid in the diagnosis of bovine reproductive problems. This can be achieved by proper sample submission (Abortion Diagnosis Kit) and by pursuing the infectious agents known to be associated with bovine abortion. The diagnostic laboratory also has the responsibility to investigate newly recognized agents, such as the non-IBR herpesvirus and to determine if there is a disease relationship that can be prevented by management procedures.

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