BOVINE VIRAL DIARRHEA AND MUCOSAL DISEASE COMPLEX

- Bovine viral diarrhea is a common viral disease that affects cattle worldwide, it is caused by a Pestivirus, it gives rise to significant economic losses in both dairy and beef cattle through its effects on production and reproduction. It affects the
- respiratory,
- digestive,
- reproductive,
- lymphoid, and
- nervous system. .

Bovine viral diarrhea virus can lead to a variety of clinical outcomes that range from

Subclinical infections to the

more severe presentations including abortion, infertility, and the fatal mucosal disease.

- The condition is highly immuno-suppressive and secondary respiratory and enteric complications often occur. BVD affects cattle of all ages, however most commonly seen in cattle 8-24 months of age.

Bovine Viral Diarrhea (BVD)

- Occurs world wide, affects cattle of all ages, however most commonly seen in cattle 8-24 months of age.

- *clinical signs range from subclinical to the fulminating fatal condition called mucosal disease.*

- BVDV is endemic globally, its *ease of transmission,

  * irregular incubation periods,
  *frequency of inapparent or undiagnosed infection

* and the presence of PI animals , all make it an epidemiologically complex viral disease.

Etiology: Caused by a virus

G. Pestivirus,
F. Flaviviridae. ssRNA virus.

Occurs in two genotypes;

- Bovine viral diarrhea virus (BVDV-1 & BVDV-2)

There is tendency for BVDV subtypes and strains to mutate causing emerging of antigenically variant viruses.

And in two biotypes;

-Cytopathic biotype (CPBVDV), kills susceptible cell cultures.

-Non Cytopathic biotype (NCBVDV), has little effect on cultured cells..

Both are represented in each viral genotype.

Cattle that are persistently infected with noncytopathic BVDV serve as a natural reservoir for virus.

BVD

Transmission through contact with infected cattle by:

- Inhalation or
- Ingestion
- Of infected saliva, nasal discharge, ocular discharge, urine or feces.

BVD is immunosuppressive disease.

Clinical signs depend on the timing of infection and status of the animal:

I. Pregnant animals:

1. If infection is acquired by a cow between 55 and 100 days of gestation (before 120 days of gestation).

a. Abortion is likely to occur.

b. Production of persistently infected (PI) calves.

- Persistently infected (PI) cattle are those animals infected *in utero* with non-cytopathic BVD during the first four months of pregnancy. These animals are persistently infected and later, either develop
  a. Mucosal disease or
  b. Chronic BVD following exposure to non-cytopathic BVD, these animals shed virus while alive.

PI Animals:

- PI animals are produced when a fetus is infected while partially immunocompetent, thus recognizing the viral cells as self and not mounting an immune response. They are therefore antigen positive and antibody negative.
- PI animals tend to never reach their productive potential, exhibiting stunted growth, reduced fertility and increased susceptibility to other diseases. However, if a PI dam is able to reproduce then their offspring will be PI calves.

- These animals are a constant source of virus for other vulnerable members of the herd and therefore a significant risk and a vital target for BVD control programs.
- They cannot be identified serologically as they are seronegative. PI animals are virus positive so they can be detected by antigen test (e.g. PCR).

2. Animals infected with BVD during late pregnancy (120-150 days of pregnancy) may produce calves with congenital defects (cerebral hypoplasia, cataracts, tight curly hair or lack of hair. Sometimes produce calves that are referred to is having “weak calf syndrome”.

3. Infection in the third trimester (180–300 days) can still cause
   a. abortion.
   b. but most commonly produce a normal but seropositive calf due to the immunocompetency of the fetus.

II. Non-Pregnant Animals:

- BVD in non-pregnant immunocompetent animals is generally **mild** and usually presents as *respiratory disease consisting of conjunctivitis, nasal discharge, *lethargy, *decreased milk yield in cows, *depression and *a cough.
- If acute, animals will be leukopenic and immunosuppressed and mortalities may be significant.

- BVD takes on different forms

1.Acute BVD, also termed transient BVD,

- Results from infection of susceptible cattle with either noncytopathic or cytopathic BVDV with high morbidity and low mortality.
- **Severity of acute BVD is related to the virulence of the viral strain infecting the animal and does not depend on viral biotype or genotype.**

Usually: a- Mild form of the disease characterized by: fever (biphasic),

- depression,
- decreased milk production,
- transient inappetence,
- rapid respiration,
- excessive nasal secretion, excessive lacrimation, and diarrhea are typical signs of mild acute BVD.

- Clinical signs of disease usually last 1–3 days.
- Recovery is rapid and coincides with production of viral neutralizing antibody.
- Gross lesions are seldom seen in cases of mild disease.
- Lymphoid tissue is a primary target for replication of BVDV leading to reduction in WBC count, and suppression of the immune system making the animals susceptible to other diseases.

b. Severe acute form :Some isolates of BVDV induce clinically severe disease that manifests as:

- high fever [41–42°C],
- oral ulcerations,
- eruptive lesions of the coronary band and interdigital cleft,
- diarrhea, dehydration, leukopenia, and thrombocytopenia.
- In thrombocytopenic cattle, petechial hemorrhages may be seen in the conjunctiva, sclera, nictitating membrane of the eyes; and on mucosal surfaces of the mouth and vulva.

- Prolonged bleeding from injection sites also occurs.
- Swollen lymph nodes, erosions and ulcerations of the GI tract, petechial and ecchymotic hemorrhages on the serosal surfaces of the viscera, and extensive lymphoid depletion are associated with severe forms of acute BVD.
- The duration of overt disease may be 3–7 days. High morbidity with moderate mortality is common.
- In confined cattle or stressed cattle acute BVD may cause severe respiratory disease or diarrhea.

2. Mucosal disease: *Mucosal disease can arise only in persistently infected animals.*

Highly fatal form of BVD that may be

- acute or.
- chronic.

It is seen infrequently in persistently infected cattle.

- **Mucosal disease is induced when persistently infected cattle become super infected with cytopathic BVDV.**
- **The origin of the cytopathic BVDV is usually internal, resulting from a mutation of the resident persistent, noncytopathic BVDV.**

- In those cases, the cytopathic virus is antigenically similar to the resident noncytopathic virus.
- External origins for cytopathic BVDV include other cattle and modified live virus vaccines.

a. Acute form of MD;

- Shows classical BVD symptoms including oral and gastrointestinal ulcers and diarrhea.
  - Fever 104-106^{0}F, mild bloating, anorexia, depression, erosive lesions of the nares and mouth, and dehydration.
  - Fecal material may have blood in it from hemorrhaging ulcers.
  - Animals can die with 48 hrs (due to severe dehydration caused by high fever and diarrhea).

- At necropsy, erosions and ulcerations may be found throughout the GI tract. The mucosa over Peyer's patches may be hemorrhagic and necrotic. Extensive necrosis of lymphoid tissues, especially gut-associated lymphoid tissue, is seen on microscopic examination.

b. Chronic form of MD:

- may last several weeks to months.
- less severe than those of acute mucosal disease.
- Intermittent diarrhea and gradual wasting are common.
- Coronitis and eruptive lesions on the skin of the interdigital cleft cause lameness in some cattle.
- Lesions found at necropsy are less pronounced than, but similar to, those seen in acute mucosal disease.

Treatment of BVD: Remains limited primarily to supportive therapy.

Control is based on:

- Sound management practices that include use of biosecurity measures,
- Elimination of persistently infected cattle, and vaccination.
- Replacement cattle should be tested for persistent infection before entry into the herd.

- Quarantine or physical separation of replacement cattle from the resident herd for 2–4 wk should be considered, and vaccination of replacement cattle for BVD should be done before commingling with the resident herd.

Prevention

1. Vaccination

a. Two injections of killed vaccine are necessary. A single initial dose of vaccine does not provide adequate protection. This vaccine can be safely administered to pregnant animals.

b. A modified live BVD vaccine for use in non-pregnant animals. A single dose of vaccine is adequate.

Diagnosis

- 1. BVD is diagnosed tentatively from disease history, clinical signs, and gross and microscopic lesions.

2. virus isolation from blood, nasal swab specimens, or tissues confirms active infection

Identification of persistent infection requires detection of virus in clinical specimens obtained at least 3 wk apart. At necropsy, tissues of choice for viral isolation include spleen, lymph node, and ulcerated segments of the GI tract.

3. Serology: Because antibody against BVDV is prevalent in most cattle populations, A >4-fold increase in antibody titre in paired serum samples((*acute and convalescent samples)* obtained ≥2 wk apart is necessary to verify recent infection.

- Antibody to BVDV can be detected in cattle sera by a standard virus neutralization (VN) test or by ELISA,

4. Alternatives to viral isolation include antigen-capture ELISA to detect virus in blood, serum, PCR to detect viral RNA in clinical specimens.

Differential diagnosis:

1. MCF; causes crusting of muzzle and oral erosions, mostly sporadic in nature, severe panophthalmitis, behavioral changes due to fatal encephalitis with vasculitis and perivascular cuffing on histological examination of brain.
2. Papular stomatitis: mild pox virus infection, usually seen in calves, mouth lesion contain characteristic brown streaks and irregular edges helps to differentiate fro BVD erosions, this disease is usually nonclinical and lesions are found only if mouth is opened.

- ***One month old calf with bovine popular stomatitis***

Rinderpest:

- Occur in Rinderpest enzootic areas.

VS:

- ❑ Affect swine and horses.
- ❑ causes rapidly rupturing vesicles on oral mucosa, teats, coronary bands.
- ❑ Virus isolation and serology for differentiations.