An overview of bovine herpesvirus 1

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Bovine herpesvirus 1 (BoHV-1) was demonstrated to cause disease in cattle as early as the 1920s. However, there is speculation that it was associated with disease before this. The virus is found throughout the world and is prevalent in the New Zealand cattle herd.

BoHV-1 is a DNA virus, genus *Varicellavirus*, in the family Herpetoviridae. Although it is widely distributed among cattle, its host range is limited. Large amounts of virus are shed in respiratory, ocular and reproductive secretions of infected cattle, and BoHV-1 is readily transmitted. The incubation period for BoHV-1 in naïve animals is two-to-six days. Cattle are the principal reservoir and usual source of infection.

In common with other herpesviruses, infection with BoHV-1 results in life-long, latent infections in the nervous tissue. Latent infections are unidentifiable clinically but can be reactivated by stress or corticosteroid therapy. Re-excretion of the virus is usually clinically silent but the amount of re-excreted virus can be high and last for several days. Thus, transmission of BoHV-1 is perpetuated by direct contact between infected cattle as well as by virus shedding due to reactivation of latent infection.

BoHV-1 eradication campaigns have been implemented in several European Union countries. These tend to employ vaccination (using marker vaccines), serological testing and movement control.

Virus subtypes

All viral isolates of BoHV-1 to date belong to a single viral species with three subtypes: BoHV-1.1, BoHV-1.2a and BoHV-1.2b.

Most BoHV-1.1 strains have been isolated from respiratory tract disease (or abortion cases) and BoHV-1.2 strains from genital organ lesions. However, this distinction is not exclusive, and nasal infection with BoHV-1.2 can cause respiratory disease and intrauterine inoculation with BoHV-1.1 can cause genital lesions. In practice, it is difficult to distinguish between the isolates obtained from reproductive and respiratory mucosae

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due to their close immunological and genetic relatedness.

Conditions associated with BoHV-1

There are many clinical manifestations of infections with BoHV-1. Severity ranges from overt clinical signs to clinically inapparent infections.

BoHV-1 has also been associated with abortion, although this association has not been detected in New Zealand to date. In addition, BoHV-1 is associated with a fatal systemic condition in newborn calves. This presentation is suspected to occur but has not yet been confirmed in New Zealand.

Under New Zealand conditions, BoHV-1 infection often results in subclinical disease or presents with mild clinical signs. This mild disease tends to affect a large number of animals within a short time. Clinical signs include milk drop, depression, inappetence, rise in temperature, fever, coughing and profuse nasal discharge. In addition, conjunctivitis with profuse ocular discharge may sometimes be seen. The clinical course in affected animals is usually completed within seven to 14 days.

More severe disease does occur, with many animals in an affected herd showing signs of an upper respiratory tract infection accompanied by a significant drop in milk production. In this presentation, mainly two-year-old dairy heifers are affected because they are exposed to the virus when entering the dairy herd. Older cows can also be affected, however.

Infections with BoHV-1 are rarely fatal unless complicated by secondary bacterial infection. Latent infections or reactivation of latency are always features of infection with this virus.

Infectious bovine rhinotracheitis (IBR)

IBR is a highly infectious and contagious upper respiratory tract disease caused by BoHV-1. Clinically, it is characterised by rhinitis, tracheitis and fever.

Acute outbreaks of IBR may occur when cattle are crowded together, for example, during transport or in feedlots. IBR is spread by clinically affected cattle, or subclinical shedders, via coughing of virus-laden nasal sections or via nasal, ocular and oral discharges containing the virus being dropped into feed or water.

Infectious pustular vulvovaginitis (IPV)

Genital infection with BoHV-1 can lead to IPV in females. The main source of genital infection is venereal transmission during mating. Infection can be subclinical. In general, IPV is not observed in respiratory outbreaks (and vice versa).

IPV is less commonly observed than IBR but can have marked effects upon the fertility of affected animals.

The presenting lesions of IPV occur one-to-three days after mating with an infected bull. Infection of the vaginal and vulval mucosa with BoHV-1 results in vesicles, pustules and erosions or ulcers in the mucosal surface. An associated mucopurulent vaginal discharge, accompanied by dysuria may be present. Affected cows may appear uncomfortable, inappetent and exhibit obvious pain during their frequent attempts to urinate.

Fertility during this time can be reduced due to an unwillingness to allow mating. Acute infection is a primary cause of early embryonic mortality. IPV has been implicated in long, irregular returns to oestrus ("phantom" cows).

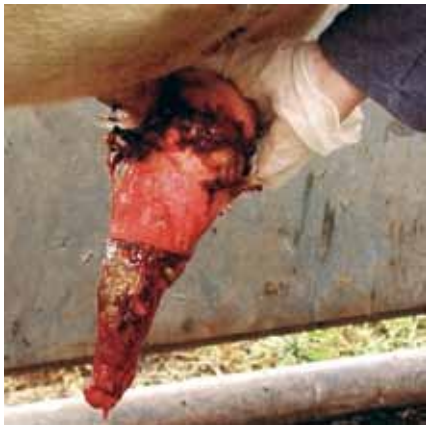
Healing of the ulcers takes place over two-to-three weeks and fertility returns to normal as they heal.

Infectious pustular balanoposthitis (IPB)

Genital infection with BoHV-1 can lead to IPB in males. As with IPV, infection is spread via venereal transmission.

Balanoposthitis is infection of the penis and prepuce. It is relatively common in the bull. Low-grade infection of the preputial cavity rarely causes clinical disease, but severe balanoposthitis can cause pain, unwillingness to serve, preputial stenosis and adhesions between the penis and prepuce. BoHV-1 is the cause of severe, ulcerative infection localised in the genital tract (IPB). Small raised nodules, vesicles and necrotic foci are initially seen, which develop into deep ulcers or coalesce to produce large areas over which the penile integument has sloughed.

Figure 1: Acute balanoposthitis due to BoHV-1 infection



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Pyrexia may be a feature of transient infection with BoHV-1. Any temperature spike in bulls has the risk of a negative effect on semen quality "down-stream" for up to eight weeks. Cows served by bulls with mild or early infection may develop signs of IPV.

Mild cases of IPB heal without complication over one-to-two weeks. There is a risk of penile or preputial scarring secondary to severe balanoposthitis, which can result in adhesions between the penis and prepuce.

Contaminated semen and semen collection equipment can constitute a hazard. The virus can survive in frozen semen. Insemination of susceptible cattle with semen containing BoHV-1 can cause endometritis, shortened oestrus periods and reduction in conception rates in the recipient cow or heifer.

Animals that have had genital BoHV-1 infection can develop a similar latency as cattle that have been infected with IBR.

Other associated conditions

BoHV-1 infection is associated with conjunctivitis with ocular discharge. This is often seen in association with IBR symptoms.

An important aspect of infections of all types of BoHV-1 (in common with other members of the herpesvirus family) is that the infected animal becomes a latent carrier. Reactivation of this latency can explain why viral infection and transmission is most often seen during periods of stress.

Prevention and control

Prevention via vaccination before "risk" periods is the recommended course of action.

Vaccination programmes can protect against the effect of transient infection (and therefore prevent symptoms that occur in even mild infections such as fever, inappetence, depression and nasal discharge).

In addition, the primary immune response acquired following a BoHV-1 natural exposure or a vaccination programme is able to successfully control the re-excretion of a latent carrier.

All bulls should be vaccinated (in combination with BVD vaccination) before the start of mating. This means:

- if the bull was naïve (and mixed with an infected or latently infected animal(s)) he will not succumb to transient infection
- if the bull is latently infected he will not infect the herd or naïve members of the herd (as reactivation of latency will be controlled).

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The recommendation to vaccinate calves against BoHV-1 can also be justified. This is especially the case if they are to be transported long distances or co-mingled with animals from other farms. Again, this minimises any impact of transient infection. It also controls latency reactivating (if the calf is already a carrier) and, therefore, spreading virus to naïve members of the group. Calves sent to grazing are often under significant stress from numerous factors (nutritional, social, infectious challenge, parasitic challenge and so on). Therefore, insurance to minimise the impact of disease is generally cost effective for dairy farmers.

In the event of an outbreak, hygiene measures are the best method available in New Zealand to limit spread. In practice, this requires the isolation of clinically affected animals.

International eradication schemes are based on vaccination, blood testing and movement control.

Summary

- BoHV-1-infected animals remain latent carriers of the herpesvirus.
- Reactivation of latency can occur during periods of stress, meaning the virus is likely to be shed without clinical signs.
- IBR is a highly infectious and contagious upper respiratory tract disease caused by BoHV-1.
- IBR can be accompanied by profuse oculo-nasal discharge.
- IPB and IPV cases have been reported throughout New Zealand.
- BoHV-1 in New Zealand is not associated with abortion.
- BoHV-1 can predispose to more severe respiratory disease especially if followed by secondary bacterial infection.
- BoHV-1 can cause severe, systemic disease in neonatal calves – this presentation is suspected, but not confirmed, in New Zealand.
- Vaccination can be used to limit spread of the virus.
- The primary immune response acquired following BoHV-1 natural exposure or vaccination can control re-excretion by a latent carrier.

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