Hemorrhagic Disease of White-tailed Deer

Hemorrhagic disease (HD) is the most important viral disease of white-tailed deer in the United States, and occurs over a large part of the country, although the frequency and severity of outbreaks vary regionally. The disease is caused by related orbiviruses (Hemorrhagic disease virus (EHDV) and Blue-tongue virus (BTV)) that are spread by biting midges (Culicoides). These viruses do not infect humans, and humans are not at risk by handling infected deer, eating venison from infected deer, or being bitten by infected Culicoides. 

Impact of Hemorrhagic Disease on Deer Populations

The severity and distribution of hemorrhagic disease are highly variable. Past occurrences have ranged from a few scattered mild cases to dramatic outbreaks. Cases vary regionally. The disease is caused by related orbiviruses (Hemorrhagic disease virus (EHDV) and Blue-tongue virus (BTV)) that are spread by biting midges (Culicoides). These viruses do not infect humans, and humans are not at risk by handling infected deer, eating venison from infected deer, or being bitten by infected Culicoides. Deer with generalized disease are not suitable for consumption.

Diagnosis of Hemorrhagic Disease

A strong tentative diagnosis can be made on the basis of history and presentation, combined with field necropsy and observation of lesions. A confirmed diagnosis of EHDV or BTV infection requires virus isolation or polymerase chain reaction (PCR) detection of viral nucleic acids. The preferred specimens for virus isolation or PCR are refrigerated spleen and lung from a fresh carcass. Lymph node or whole blood in anticoagulant are also suitable samples.

Human Health Implications

These viruses do not infect humans, and humans are not at risk by handling infected deer, eating venison from infected deer, or being bitten by infected Culicoides. Deer with generalized disease are not suitable for consumption.

Livestock Implications

Past outbreaks have revealed that simultaneous infections sometimes occur in deer, cattle, and Bovidae. The disease in cattle and Bovidae is not at risk of infection. While the significance of EHDV and BTV to white-tailed deer is established, the importance of these agents to domestic livestock is more difficult to assess. Most BTV infections in cattle are subclinical; however, a small percentage of animals can develop fever, lameness, ear morchiae, and reproductive problems. Similarly, EHDV rarely can cause clinical disease in cattle, and surveys have shown that cattle often have antibodies to this virus, indicating frequent exposure. Domestic sheep are generally unaffected by BTV, but BTV can cause severe disease similar to that in deer. Hemorrhagic disease can have severe impacts in captive white-tailed deer, especially in animals translocated from northern to endemic areas in the Southern United States. Reliable, commercially available vaccines are not currently available.

Control and Prevention of Hemorrhagic Disease

At present, there are no wildlife management tools or strategies available to prevent or control hemorrhagic disease. Although die-offs of white-tailed deer due to hemorrhagic disease often cause alarm, past experiences have shown that mortality will not decimate local deer populations and that the outbreak will be curtailed by the onset of cold weather. Livestock owners who suspect EHDV or BTV infections should seek veterinary assistance to get disease diagnostics and support care for their animals.

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Deer die-offs consistent with HD were noted as early as 1886, and EHD virus (EHDV) and BT virus (BTV) isolations from infected deer were first reported in 1955 and 1956, respectively. Prior to 2000, only two serotypes of EHDV (EHDV-1 and 2) and five serotypes of BTV (2, 10, 11, 13, 17) were known to be present in North America. However, multiple EHDV and BTV serotypes have been associated with HD more recently and one serotype in particular, EHDV-6, continues to be detected regularly during HD outbreaks in deer.

The Vectors

Although EHDV and BTV are infectious to a wide range of wild ruminants, susceptibility varies among species. Clinical disease due to EHDV has been documented in white-tailed deer, mule deer, bighorn sheep, elk, bison, and pronghorn, and clinical disease due to BTV has been reported in these species as well as in black-tailed deer. Infections in these wild ruminants can range from mild or no disease to episodes of high mortality. Antibodies or virus also have been detected in mountain goats; however, disease has not been reported in this species. In parts of the Southeast, mild infections in white-tailed deer, bighorn sheep, and elk are common and are evidenced by lameness and emaciation. The seasonal distribution of hemorrhagic disease coincides with periods of biting midge abundance. The onset of freezing temperatures in late fall sets medical vectors and populations in the areas where these deer species are found.

The onset of freezing temperatures in late fall affects vector populations and usually brings a sudden end to hemorrhagic disease outbreaks. How the viruses persist through the winter when midges are not active is not clear. However, it is believed that in areas with a mild climate, vector populations may remain active and locally support year-round virus transmission.

Important Questions Concerning Hemorrhagic Disease in Deer

What are the Clinical Signs and Lesions of Hemorrhagic Disease?

Clinical signs of infection are highly variable and many infected deer appear normal or show only mild signs of illness. When illness occurs, signs and lesions change as the disease progresses. In an acute infection, animals may stagger or be depressed and feverish, with a swollen head, neck, tongue, or eyelids, and breathing difficulty. Deer may die within 1 to 3 days. More often, deer survive longer and may become lame, lose their appetite, or reduce their activity. A smaller proportion of animals may survive infection but die for weeks or months by lameness or emaciation. Lesions, as outlined below, can be quite variable in deer depending on the immune status of the host and duration of infection. The development of different lesions as the disease progresses is linked to categorization of 3 ‘forms’ of hemorrhagic disease: peracute, acute, and chronic. The peracute, or very rapid form, may show only severe fluid swelling (edema) of the head, neck, tongue, eyelids, and lungs. In animals living somewhat longer, the acute or ‘classic hemorrhagic’ form occurs. These animals may have edema in the same locations but also have hemorrhages or congestion in the heart, pulmonary artery, oral mucosa, rumen, abomasum, or intestines. There may be erosions or ulcerations on the dental pad, tongue, palate, rumen, omasum, and abomasum. The chronic form is typified by growth interruptions of the hoof, and may produce similar edematous, hemorrhagic, or ulcerative lesions.

Where Do EHDV/BTV Infections and Hemorrhagic Disease Occur?

Infections refer to the invasion and multiplication of the virus in deer or other ruminants, while disease refers to the production of noticeable clinical signs. The national distribution of hemorrhagic disease outbreaks from 1980 - 2015 is shown on the map. Mortality due to clinical hemorrhagic disease in the U.S. past thirty-plus years has shown that infection with EHDV and BTV is much more common and geographically widespread than clinical hemorrhagic disease in white-tailed deer. The seasonal distribution of hemorrhagic disease outbreaks in white-tailed deer from 1980-2015 is shown on the map. Mortality due to clinical hemorrhagic disease in the U.S. past thirty-plus years has shown that infection with EHDV and BTV is much more common and geographically widespread than clinical hemorrhagic disease in white-tailed deer.