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**Original Article**

## Hemorrhagic Septicemia

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Hemorrhagic septicemia is a bacterial disease that mainly affects cattle and water buffalo, and is an important cause of livestock mortality in tropical regions of Asia, Africa and the Middle East. The clinical signs usually progress rapidly from fever and depression to death, within hours to a few days. Young animals are mainly affected in endemic regions, and outbreaks are particularly common during rainy weather, when the organism can spread readily. In areas where animals have no immunity, severe disease is expected to occur in all ages.

### Etiology:

Hemorrhagic septicemia is caused by certain members of *Pasteurella multocida* subsp. *multocida*, a Gram-negative coccobacillus in the family Pasteurellaceae. *P. multocida* isolates are traditionally identified by a letter designating the organism's serogroup (A, B, D, E or F), based on the capsular antigen, and a number for the somatic antigen. Classically, hemorrhagic septicemia was considered to be caused by just two serotypes of *P. multocida* ssp. *multocida*, which are called B:2 and E:2 in the Carter-Heddleston serotyping system, or 6:B and 6:E, respectively, in the alternative Namioka-Carter system. However, other serotypes (e.g., types A:1 and A:3 in cattle and water buffalo in India) have occasionally been isolated from animals with a syndrome clinically indistinguishable from hemorrhagic septicemia.

### Epidemiology:

Hemorrhagic septicemia is an important disease of cattle and water buffalo in Asia, Africa and the Middle East. The highest incidence is in Southeast Asia. Cases have also been reported sporadically in Europe, where this disease is said to occur mainly in southern Europe but has also been seen occasionally in other countries, including those with cold climates (e.g., Estonia, Latvia, Georgia, Ukraine). Several outbreaks have been reported since 2010 in Central Europe, suggesting that the causative organisms may have been introduced to this region after apparently being absent for decades. Serotype B:2 is the major cause of hemorrhagic septicemia in Asia, although a few clinical cases are apparently caused by other serotypes, including members of serogroup E. B:2 is also prominent in Europe and the Middle East. In India from 1974–1986, HS was responsible for the highest mortality rate of infectious diseases in buffaloes and cattle, and was second in its morbidity rate in the same animals.

### Transmission and Incubation period:

Hemorrhagic septicemia can be transmitted by ingestion or inhalation, either during direct contact or via fomites such as contaminated feed and water. The causative organisms are thought to spread mainly in respiratory secretions, but they can also be found in other secretions and excretions, including feces and urine. Some infected animals become carriers, maintaining *P. multocida* ssp. *multocida* in the lymphatic tissues (e.g., tonsils) associated with the upper respiratory tract, and periodically shedding it in nasal secretions. The incubation period is thought to be 3-5 days in most cases, although it can be much shorter (e.g., a few hours) in experimentally infected cattle or water buffalo that are inoculated with lethal doses. Some animals carry the organism asymptotically for varying periods before becoming ill.

### Clinical Signs:

Hemorrhagic septicemia is an acute or peracute illness. Most clinical cases have been described in cattle and water buffalo. Although the disease is very similar in both species, buffalo tend to have more severe signs and a shorter course. Typically, a fever, depression and other nonspecific

clinical signs (e.g., a drop in milk production) are quickly followed by excessive salivation and a profuse serous nasal discharge. The nasal discharge may become mucopurulent if the animal survives longer. Other characteristic signs include dyspnea, which may be accompanied by frothing at the mouth or nostrils, and edematous swellings in the submandibular region. These swellings may spread to the neck and brisket, and sometimes to the forelegs. Some animals may have diarrhea and abdominal pain, or hemorrhagic gastroenteritis. Although neurological signs do not seem to be evident in most cases, evidence of meningitis or hemorrhagic encephalitis have been found in the brains of some cattle and water buffalo at necropsy. Animals with hemorrhagic septicemia usually collapse and die within a few hours to a few days after the onset of the illness. Sudden death with few or no clinical signs can also be seen.

#### **Post Mortem Lesions:**

The gross lesions are consistent with severe sepsis, and are usually characterized by widespread hemorrhages, edema and hyperemia. However, there may be few or no lesions other than a few scattered petechial hemorrhages in some peracute cases. Subcutaneous edema (a gelatinous mass with straw-colored or bloodstained fluid) can usually be found in the submandibular region and neck, sometimes extending to the brisket or legs. The thoracic and abdominal cavities and pericardial sac often contain blood-tinged, serous to serofibrinous fluid, and petechiae are common throughout the internal organs, especially on the serosal surface. Ecchymotic hemorrhages may also be found, particularly on the heart. The lungs are diffusely congested and edematous and may contain hemorrhages. Extensive pneumonia, though possible, is atypical. The digestive tract of some animals may be hyperemic and congested, and the abomasum and intestinal mucosa sometimes contain petechiae and ecchymoses. The brain is rarely examined, but meningitis can be found in cattle and experimentally inoculated buffalo calves.

#### **Diagnosis:**

The *P. multocida* strains that cause hemorrhagic septicemia can be cultured from blood in the terminal stages of the disease, but may be absent from samples collected earlier. These organisms can also be found sometimes in nasal secretions or body fluids. In blood or tissue smears, *P. multocida* is a Gram-negative, short rod or ovoid form with bipolar staining. Bipolar staining is more apparent with methylene blue, Leishman's stain or Giemsa. A definitive diagnosis is usually made by culturing hemorrhagic septicemia-associated *P. multocida* strains from affected animals. Biochemical and serological tests and/or polymerase chain reaction (PCR) techniques can also be used for the identification of colonies.

#### **Treatment:**

Antibiotics are effective only if they are started very soon after the onset of clinical signs. A common practice during outbreaks is to monitor animals for fever and treat febrile animals immediately. Some drugs used to treat hemorrhagic septicemia include oxytetracycline, trimethoprim/ sulfamethoxazole, a combination of penicillin and streptomycin, or sulphaquinoxaline.

#### **Prevention and Control:**

Treatment is of little use once signs of HS have appeared, but could be effective in the early stages. Sanitary control measures include early detection and isolation of new cases and their immediate treatment with antibiotics, deep burial of carcasses or incineration, and the prevention of movements of animals to disease free areas. Vaccination of susceptible animals in endemic areas is the only practical approach to prevent HS. Although the available vaccines are effective in providing protection, disease outbreaks still occur due to low vaccination coverage. Simple bacterins for *P. multocida* protect relatively well, as they are based on the capsule of *P. multocida*. The OIE recommends to use a local isolate of *P. multocida* representing the prevalent serotype. The commonly used HS vaccines are bacterins: alum-precipitated vaccines (APV), aluminum hydroxide (AlOH) gel vaccines, and oil-adjuvanted vaccines (OAV). To provide sufficient immunity with bacterins, repeated vaccination is required. Administration of dense bacterins can give rise to shock reactions, which are less frequent with the APV and almost nonexistent with the OAV. The APV provides immunity for 6 months, while the OAV provide immunity for up to 1 year. However, the OAV have not been popular because of their high viscosity making it difficult to use.