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Haemorrhagic Septicemia in Bovines : Its Diagnosis and Therapeutic Management

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Abstract:

Haemorrhagic Septicemia has been a fatal global disease since decades of high economic importance due to its endemicity, frequent outbreaks, mass livestock losses, diminished productivity, high treatment cost and trade restrictions. Haemorrhagic Septicemia (HS), caused by *Pasteurella multocida* (B:2, E:2), is a rapidly fatal disease of cattle and buffaloes in tropical regions. Triggered by stress and poor management, it presents with fever, submandibular edema, and respiratory distress. Diagnosis involves clinical signs, post-mortem findings, and confirmation via culture and PCR. Treatment combines supportive care and antibiotics. Control relies on timely vaccination, biosecurity, and farmer education. Effective prevention is key to reducing high morbidity and mortality.

Introduction:

Haemorrhagic Septicemia (HS), also referred to as Stockyardis Pneumonia, Barbone disease, or simply Pasteurellosis, is a rapidly progressing and often fatal disease affecting large numbers of animals, leading to sudden deaths. The incubation period is typically 1 to 3 days. Clinical signs include a sharp increase in body temperature (104°–107°F), septicemia, breathing difficulties, moist lung sounds, and painful swelling beneath the jaw due to submandibular edema. Other symptoms involve deep red mucous membranes, hemorrhagic inflammation of the gastrointestinal tract, meningitis, and hemorrhagic encephalitis (Ranveer et al., 2018). The disease also poses a zoonotic risk, especially in individuals with weakened immune systems, where it may result in soft tissue infections, bone infections (osteomyelitis), endocarditis, meningitis, respiratory illness, or septicemia. Various environmental and management factors contribute significantly to HS outbreaks. These include the rainy season, elevated temperatures, high humidity, stress from shipping, overcrowding, mixing of animals, poor nutrition and fodder supply, substandard herd management, and low disease resistance among certain species (Tita et al., 2025).

Recovery is rare, as the disease advances too swiftly for effective diagnosis or treatment. While pneumonic pasteurellosis in cattle may lead to a high number of illness cases, its mortality rate is generally lower in comparison (Flor and Pilapil, 2020).

Etiology:

According to the Carter–Heddleston classification system, the typical cause of Haemorrhagic Septicemia (HS) is *Pasteurella multocida*, specifically serotypes B:2 and E:2. Among these, serotype B:2 is most frequently observed in regions where the disease is endemic, whereas E:2 is generally confined to Africa. These serotypes are also classified as 6:B and 6:E in the Namioka-Carter classification system (Ahmed et al., 2014; Ranveer et al., 2018; Tawab et al., 2020). Pasteurella multocida is a Gram-negative bacterium that usually exists Commensally in the upper respiratory tract, particularly the nasopharynx. However, it becomes pathogenic and multiplies rapidly under stressful environmental conditions, during seasonal disease outbreaks, or when the host's immune system is weakened, leading to opportunistic infections (Harper and Boyce, 2017).

Morphologically, *P. multocida* often appears in various shapes (pleomorphic), especially in aged cultures. The bacteria may be seen singly, in pairs, or as short chains. It is classified as mesophilic and chemo-organotrophic, possessing both fermentative and oxidative metabolic abilities. The organism's carbohydrate metabolism can vary significantly depending on host stress, environmental factors, and the irrational use of antimicrobial agents that may alter enzyme profiles (Hanchanachai et al., 2021).

Multiple classification systems exist for serotyping this pathogen. One of the earliest was proposed by Robert, who divided it into four immunological groups (I–IV) based on passive protection in mice, with Hudson later adding a fifth group. Namioka and Murata developed a system of 11 serotypes based on the tube agglutination method. Heddleston used the agar gel precipitation test to classify 16 somatic serotypes, while Carter's capsular typing system identified five capsular groups (A, B, C, D, E) using the indirect haemagglutination technique (Tita et al., 2025).

Epidemiology:

Haemorrhagic Septicemia (HS) affects a wide range of domestic and wild animals. Susceptible hosts include water buffaloes, cattle, calves, pigs, goats, sheep, American bison, elephants, dromedary camels (Camelus dromedarius), horses, donkeys, yaks, and deer species like fallow deer (Dama dama). Additionally, free-ranging Saiga antelopes have experienced devastating outbreaks, with significant population losses. Among domestic animals, buffaloes are approximately three times more vulnerable than cattle, and young calves between 6 months and 2 years of age are particularly at risk due to underdeveloped immune systems (Ranveer et al., 2018).

The disease frequently causes deadly seasonal epidemics, especially in tropical and Southeast Asian regions, as well as Africa and the Middle East. These outbreaks are most common in developing

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and economically disadvantaged countries, where mortality rates can reach up to 100% in endemic zones during active outbreaks (Flor and Pilapil, 2020).

In India, the pattern of HS outbreaks varies widely both between different states and within each state across different years (Chanda et al., 2024). Over the last four decades, HS has been responsible for around 45% to 55% of cattle deaths in the country, with an estimated annual loss of nearly 5 million animals. One of the key factors contributing to this high mortality is the inadequate duration of immunity provided by current vaccines (Bardhan et al., 2020).

Clinical Signs:

Hemorrhagic Septicemia (HS) is classified as an acute to peracute infectious disease, particularly severe in buffalo calves aged 4 to 10 months. The incubation period varies with the mode of infection: approximately 30 hours for oral exposure, 12–14 hours when transmitted subcutaneously, and 46–80 hours under natural conditions. The disease progresses in three distinct clinical phases:

- Phase One is marked by a sharp rise in body temperature (104–107 °F), accompanied by lethargy and loss of appetite.
- Phase Two presents with rapid breathing (40–50 breaths per minute), nasal discharge, difficulty in breathing, salivation, and swelling beneath the jaw (submandibular edema), which may extend to the chest (pectoral area) and even the forelimbs.
- Phase Three involves recumbency, severe respiratory distress, and ultimately systemic septicemia.

Upon post-mortem examination (necropsy), the most prominent finding is swelling in the submandibular and brisket (pectoral) areas. Additionally, petechial hemorrhages are commonly observed under the skin and within the thoracic cavity. As the disease advances, the lungs may become consolidated, leading to reduced or absent lung sounds during auscultation. (Bullers, 2016). A significant aspect of HS pathogenesis is the role of platelets, which are vital for maintaining haemostasis and regulating thrombosis (Das et al., 2021; Das et al., 2022).

Diagnostic Methods:

The diagnosis of Haemorrhagic Septicemia (HS) as the cause of death in affected animals is established by integrating findings from anamnesis, clinical signs, laboratory testing, and post-mortem examinations. Clinically, suspicion arises when typical signs such as submandibular swelling and fatigue are observed, especially in group-housed animals.

Laboratory confirmation is carried out using bacterial culture, blood tests, and molecular diagnostics like PCR assays. The pathogen is isolated and identified using bipolar staining techniques with stains such as Giemsa, Leishman, or methylene blue. For sampling, blood should be collected using heart swabs shortly after death, while cultures from internal organs and bone marrow (after proper surface sterilization) may also be performed. Among tissues, the spleen and brain are generally the last to show contamination post-mortem.

Bacterial growth media used for culturing Pasteurella multocida include blood agar, brilliant green agar, dextrose starch agar, and CSY agar supplemented with 5% blood (casein, sucrose, and yeast extract). Colonies typically appear as non-haemolytic, dew drop-like formations.

For strain characterization and serotyping, advanced methods such as Pulsed Field Gel Electrophoresis (PFGE) and Multilocus Sequence Typing (MLST) are utilized. Additionally, Loop-Mediated Isothermal Amplification (LAMP) offers a rapid alternative for pathogen detection. Although serological assays like ELISA are not suitable for acute diagnosis—as animals often die before generating detectable antibodies—they can be useful in retrospective studies. High antibody titres (≥1:160) may be found in animals that have survived or been in close contact with infected individuals.

In terms of biochemical identification, the organism tests positive for oxidase, catalase, and alkaline phosphatase. It can metabolize a wide range of sugars such as mannose, glucose, galactose, sucrose, L-sorbose, fructose, m-inositol, rhamnose, and adonitol. However, it is unable to hydrolyse aesculin, salicin, or starch, and tests negative for lysine decarboxylase, urease, gelatine liquefaction, and arginine dihydrolase (Spickler, 2019).

For an accurate diagnosis and appropriate treatment strategy, it is crucial to differentiate HS from other peracute respiratory or nasal diseases such as allergic rhinitis, verminous pneumonia, aspiration pneumonia, and enzootic nasal granuloma.

Treatment:

The core objective in managing Haemorrhagic Septicemia is to offer symptomatic relief through supportive therapy and to ensure elimination of infection using appropriate antibiotics. Supportive management aims to reduce clinical symptoms, ease discomfort, and aid partial recovery in affected animals. This includes the use of prednisolone acetate, a synthetic corticosteroid administered intramuscularly for its anti-inflammatory effects. The pathogenesis involves Pasteurella multocida-induced destruction of blood monocytes and pulmonary macrophages, which leads to the release of histamines and prostaglandins, driving inflammation. Vitamin B-complex supplements, liver extract administered to improve the animal's overall condition, and nutritional support, Paracetamol, and meloxicam are administered for pain relief (Ranveer et al., 2018).

On the other hand, antibiotic therapy is indispensable for controlling the bacterial load. Research indicates that fluoroquinolones, tetracyclines, and cephalosporins exhibit high effectiveness against *P. multocida* strains involved in HS (Sabsabia et al., 2021; Pintér et al., 2024). In contrast, sulphonamides and clotrimazole have shown limited success in regions where the disease is endemic, largely due to antimicrobial resistance (Petrocchi-Rilo et al., 2018).

Prevention and Control:

It is essential to consult a licensed veterinarian to determine the most appropriate vaccination protocol and vaccine type specific to your geographical area. Three main types of vaccines are currently employed to prevent Haemorrhagic Septicemia: the oil adjuvant vaccine (OAV), aluminium hydroxide gel-based vaccine (APV), and solid bacterins (Kumar et al., 2015). The initial vaccination is generally recommended at 4 to 6 months of age (Muenthaisong et al., 2020). In case of an outbreak, it is advisable to administer one dose of APV followed by a dose of OAV for effective protection.

Intranasal vaccination using live or attenuated strains has shown potential in boosting local mucosal immunity in animals that are exposed or at risk, providing near complete protection. This method is especially recommended as a mass immunization strategy for entire herds, ideally 2–3 months prior to the expected outbreak season, to ensure both quick and long-lasting immunity (Fakiha et al., 2023).

Upon detection or suspicion of HS, veterinarians must strictly adhere to national or regional disease reporting protocols. Immediate steps should include the isolation of clinically ill animals and quarantine of those at risk or in contact with infected individuals. It is also vital to trace potential sources of infection, conduct health monitoring, and initiate active disease surveillance. Regular disinfection procedures, and in severe cases, humane culling of infected or highly exposed animals, are necessary to contain the spread. To prevent outbreaks, annual booster vaccinations combined with proper livestock management practices, such as avoiding overcrowding and ensuring good hygiene, are strongly advised (Spickler, 2019).

Effective biosecurity strategies include minimizing unnecessary farm visits, maintaining a log of visitors, using disinfected vehicles, and limiting entry and exit points on the premises. Farmers should be encouraged to participate in capacity-building initiatives like training sessions, awareness programs, and seminars that focus on animal health and disease control. Additionally, collaboration and information sharing among farmers, veterinarians, industry stakeholders, and online communities can play a critical role in adopting best practices and staying informed about new developments (Fakiha et al., 2023).

Conclusion:

Haemorrhagic Septicaemia (HS), caused by *Pasteurella multocida*, is a highly contagious and economically significant bacterial disease primarily affecting cattle and buffalo, with buffalo often experiencing more acute and severe manifestations. The control of this disease demands a multifaceted approach. Key strategies include prompt diagnosis based on clinical signs and lesions, effective vaccination programs, targeted antibiotic therapy, and supportive care. Preventive measures such as improved hygiene, sound animal management practices, and immunoprophylaxis are essential. Long-term control efforts should be nationally coordinated, aligned with international standards (OIE, 2000), and supported by applied research, standardized protocols, and strong veterinary-farmer collaboration. Furthermore, training and extension services are vital to ensure widespread adoption of effective HS control strategies and to mitigate its impact on the livestock industry.

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