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Hemorrhagic Septicemia

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ABSTRACT

Hemorrhagic Septicemia (HS) is a highly contagious bacterial disease affecting cattle, buffalo, and other ruminants. It is caused by *Pasteurella (P.) multocida*, primarily serotypes B:2 and E:2. It has significant economic importance in regions with endemicity or frequent outbreaks, leading to livestock losses, reduced productivity, treatment costs, and trade restrictions. Prompt diagnosis is crucial, relying on clinical evaluation and laboratory confirmation through culture, blood testing, and PCR assays. Clinical signs include fever, respiratory distress, nasal issue, and submandibular edema. Treatment includes early identification, supportive care, and antibiotic therapy targeting *P. multocida*. Vaccination plays a key role in its control, using oil-adjuvant killed vaccines or intranasal live attenuated vaccines. Prevention is by implementing biosecurity measures, maintaining sanitation, quarantining and isolating animals, monitoring and surveillance, continuous education, collaboration, and timely reporting. Effective control strategies, along with farmer awareness and cooperation, are vital in managing HS and minimizing its economic impact on the livestock industry.

Introduction

Hemorrhagic Septicemia is one of the highly infectious bacterial disease that mostly affects cattle and water buffalo but can also infect other domestic and wild ruminants. It is caused by the bacteria *P. multocida*. The infection is distinguished by high fever, sub-mandibular edema, and respiratory rales, which are followed by the animal's mortality if not treated and not handled at an early stage. The Office International des Epizooties (OIE) classifies it as a List B illness and considers it to be one of the most economically important livestock diseases due to high morbidity and mortality in endemic areas. It is regarded as the most economically damaging bacterial disease of cattle and water buffalo in tropical and southeast Asian countries notably Pakistan India.

Etiology

Classical hemorrhagic septicemia, as described by the OIE, is caused by *P. multocida* serotypes B:2 and E:2. Serotype B:2 has been discovered in the majority of endemic locations, but serotype E:2 has only been found in Africa. Other *P. multocida* serotypes induce septicemic pasteurellosis, which is clinically identical to HS. Dramatic weather changes, such as the arrival of the monsoon, weakness brought on by seasonal low nutrition levels, and work stress are some of the risk factors that contribute to the disease's incidence in Pakistan [1].

Economic Importance

HS plays a significant role in economic importance, mostly in regions where the disease is endemic or outbreaks occur frequently. Loss of livestock, reduced productivity, treatment cost, trade restriction, there can be some indirect economic implication related to public health significance are involved that affect economic importance of the country. It is viewed as a disease of significant economic significance in Pakistan. The losses attributable to HS are more than 2.17 billion Pakistani rupees just in Punjab. An estimate places the number of cattle in Pakistan at 24.2 million and the number of buffalo at 26.3 million [1].

Clinical Signs

HS in cattle and buffaloes has been associated with a wide range of clinical symptoms. For buffalo calves between the ages of 4 and 10 months, the incubation period varies depending on the route of disease. For oral, subcutaneous and natural infections, the incubation periods are 30, 12-14 and 46–80 hours respectively. Fever with a rectal temperature of 104-106°F (40-41°C), depression, and loss of appetite characterize phase one. Increased respiration rate (40-50/minute), clear nasal discharge, labored breathing, salivation, and submandibular edema extending to the pectoral area and even the forelegs characterize phase two. Finally, recumbency, continuing acute respiratory distress, and final septicemia are common in phase three.

Pathogenesis

Subcutaneous edema in the submandibular and pectoral (brisket) regions is the most visible gross lesion on post-mortem inspection (necropsy). Petechial hemorrhages can occur subcutaneously as well as in the thoracic cavity. Congestion and varying degrees of lung consolidation may also develop. Animals who die within 24-36 hours have few petechial hemorrhages on the heart and widespread lung congestion, but animals that die beyond 72 hours have more petechial and ecchymosis hemorrhages and more extensive lung consolidation [2]. In this disease, the role of platelets is very important as they regulate thrombosis and hemostasis [3,4].

Diagnosis

Clinical diagnosis based on history, clinical symptoms, and distinctive lesions. Based on culture and blood testing, a laboratory diagnosis is made. We also perform PCR assay that are highly specific and sensitive test, providing rapid and accurate diagnosis about HS infection in bovine. Standard methods of identification, such as serotyping, bio typing, antibiogram determination, and pathogenicity, were used, as well as molecular methods of identification.

Post-mortem examination is also performed to observe gross lesion and collect tissue sample for further laboratory test. Through this we identify characteristics lesion such as hemorrhage in many organs of animal, enlarged, congested lymph nodes and nodular change in respiratory tract. Or tissue sample such as lung, spleen and lymph nodes are collected for histopathological examination and isolation of bacteria [5].

Treatment

Early treatment is dependent on early disease diagnosis. In the field, HS is typically diagnosed in the majority of cases to be acute or subacute. The treatment of hemorrhagic septicemia involves in a combination of supportive care and antibiotic therapy treatment. Supportive care is used to manage the clinical sign, discomfort, alleviate pain and do some recovery in animal suffered from HS. Antibiotics are essential in HS to control bacterial infection caused by *P. multocida*. Commonly used antibiotics are broad spectrum antibiotics like penicillin, cephalosporin, and fluoroquinolones. Antibiotics treatment depend upon on factor such as disease severity, different strain of bacteria and antibiotic sensitivity testing [6].

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Control Measures

Vaccination is a major HS control tool. Despite vaccination with HS oil-based killed vaccine, an epidemic of HS occurred in buffalo calves in the current study. The widely used oil adjuvant vaccination is capable of protecting young buffalo calves from experimental HS after 250 days. In this investigation, there could have been vaccine failure. Vaccines through intranasal doses not only increase the mucosal immunity of the exposed host, but also convey the organism to in-contact hosts, stimulating their mucosal immunity as well. All (100%) non-vaccinated animals housed along with intranasally exposed animals shown identical stimulation, resulting in 100% protection of the in-contact animals against challenge .This is an intriguing discovery because there is a possibility that intranasal vaccination with live vaccine leads to self-vaccination of in-contact animals and should be considered for use in the annual vaccination regime for Southeast Asian countries where most animals are kept semi-intensively or extensively with little human contact. Completed in adequate time before the commencement of the high-risk season (monsoon), as immunization of HS for prophylactic purposes should be completed at least two to three months before the season. It is also advised that during an outbreak, regardless of past vaccination history, immediate whole herd vaccination be used. This technique similarly failed in the current outbreak, with mortality reaching 31.48%. A live-attenuated vaccine that mimics the early phases of the natural infection should be predicted to provide more firm and long-term protective immunity [5]. Bactrians, alum-precipitated and aluminum hydroxide gel vaccines, and oil-adjuvant vaccinations are the most often used killed vaccines for prevention. The oil-adjuvant vaccine gives 9-12 months of protection and is delivered once a year. It is most effective when given one month before the rainy season. Oil adjuvant vaccines, for example, have been found to generate conspicuous and persistent immunity. This makes it difficult to gather animals for vaccine injection, resulting in inadequate vaccination coverage. Disease outbreaks are frequently recorded in unvaccinated large animals. As a result, the use of intranasal live attenuated vaccines that allow self-vaccination and boost immunization coverage among animal populations may be the solution [6].

Zoonotic Risk

No human infections have yielded the HS-causing *P. multocida* serotypes. But when dealing with suspected instances of HS or HS-like disease, sufficient measures should be taken because various serotypes of *P. multocida* have the potential to infect people**.**

Guidelines for Farmer

Biosecurity Measure: Should implement biosecurity practices to prevent the introduction and spread of disease. Reduce non-essential farm traffic. Only clean, disinfected automobiles are permitted on your property. Maintain a record of all farm visitors. There should only be one entrance/exit. Make available disposable footwear. Keep other animals and strangers away from your property.

Vaccination Measure: Consult with a veterinarian to identify the best vaccination schedule and type of vaccine for avoiding HS in your location. Follow the specified vaccination protocol and make certain that all animals receive the required dose.

Sanitation and Hygiene: Animal housing and amenities must be clean and well-kept. Clean and sanitize animal watering and feeding equipment on a regular basis. Provide a clean and fresh water source, as well as efficient waste management. Hygiene and sanitation aid in the protection of livestock and crops against pests and illness, such as insects, parasites, pathogens, and weeds.

Quarantine and Isolation of Animals: Quarantine refers to isolating new or returning animals that are not known to be ill, whereas isolation refers to keeping diseased animals separate from healthy ones; in both circumstances, an isolation area is required. Provide a separate air space, water source, and feed source for your livestock [2].

Monitoring and Surveillance: All routine actions aimed at determining the health state of a specific population in order to detect and prevent animal diseases that are important to national economies, food security, and trade. Monitor animal regularly like sign of any distress, illness, nasal discharge, swollen lymph nodes and fever. Also implement surveillance program to detect animal disease outbreak, and furthermore also seek veterinary assistance to accurate diagnose and treatment of HS [7].

Education and Training: Farmers should be aware of the outbreak of HS because it's a common disease affecting livestock mostly. Farmers should have to attend the training program, workshop, or seminar on animal health, and disease related issue. Stay updated on new research and best practices to enhance your understanding and decision-making regarding disease control measure. Regarding education and training, the role of media, especially the social media in the present era, is very important. It can efficiently help different stakeholders in staying updated about the research and different aspects of disease outbreaks [8,9,10].

Collaboration and Reporting: Farmers should collaborate with other farmers, other industry association and veterinary authorities to share information, experiences and best practices. Also report any suspects or confirmed cases of HS to the relevant authorities for monitoring purposes.

Conclusion

HS is a highly contagious bacterial disease that mostly affects cattle and water buffalo and is caused by *P. multocida*. Diagnosis of HS involves a clinical evaluation that is based on history, clinical symptoms and characteristic lesions. Vaccination plays an important role in the control of HS. Supportive care can help in managing clinical signs and discomfort while antibiotics are mostly used in HS as a specific treatment to control bacterial infection. The preventive strategies and the collaboration between farmers and veterinary authorities play a crucial role in managing HS and minimizing its economic impact on the livestock industry.

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