

Popular Article

Tick-Borne Zoonotic Diseases in India: Human Impact, Significance, Diagnosis, Medication, and Tick Control Strategies

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Introduction

Ticks, as vectors of several fatal zoonotic diseases, are ranked subsequent only to mosquitoes as vectors, most emerging infectious diseases arise from zoonotic pathogens, and many of them are transmitted by tick vectors. Ticks are among the most competent and versatile vectors of zoonotic pathogens like viruses, bacteria, rickettsia, and spirochetes. The diseases spread by ticks are a major constraint to animal productivity while causing morbidity and mortality in both animals and humans. Several characteristics of ticks make them outstanding vectors of pathogenic agents-the wide host range and tendency to feed on several hosts during life cycle ensure ample opportunity to acquire and transmit pathogens; hardiness and longevity enable them to survive long periods in unfavourable environmental conditions; high reproductive potential, ensuring maintenance of large populations and a high frequency of host-vector contact; slow feeding habit and in the case of ixodids, attachment with hosts for relatively longer periods, which allow sufficient time for pathogen acquisition and transmission,

as well as tick dispersal by migrating or wandering hosts.

In humans, tick infestations typically involve few specimens and the greatest risk for people bitten by a tick lies in infection due to a tick-borne pathogen. In animals tick infestations are much more severe than in humans, animals can be parasitised by thousands of ticks, which multiply the effect on the host, either by direct injuries or disease transmission. Several tick-borne diseases affecting animals can also infect humans, posing significant public health risks:

1. Indian tick typhus (ITT)

Etiology: *Rickettsia conorii*

Vector: *Rhipicephalus* ticks

Significance: Disease in humans is characterized by sudden onset of moderate-to high-grade fever, malaise, deep muscle pain, headache, and conjunctival suffusion.

Diagnosis: The ELISA technique immunoglobulin M (IgM) capture assay (most sensitive test), Weil Felix test, and indirect immunofluorescence assay (IFA).

Medication:

- **Antibiotics:** Chloramphenicol, macrolides, rifampicin, doxycycline (drug of choice).

- **Vaccine:** No specific vaccine is available for ITT in India.

2. Crimean-Congo Hemorrhagic Fever (CCHF)

Etiology: *Nairovirus*

Vector: *Hyalomma* ticks

Significance: CCHF causes severe viral haemorrhagic fever with a high fatality rate in humans. It is a significant public health concern due to its potential for outbreaks.

Diagnosis:

- Serological tests: ELISA for IgM and IgG antibodies.
- Molecular tests: RT-PCR for detecting viral RNA.

Medication:

- **Antivirals:** Ribavirin has shown effectiveness when administered early.
- **Supportive Care:** Including fluids, oxygen, and management of bleeding.
- **Vaccine:** No specific vaccine is available for CCHF in India.

3. Kyasanur Forest Disease (KFD)

Pathogen: *Flavivirus*

Vector: *Haemaphysalis spinigera* ticks

Significance: KFD, also known as monkey fever, primarily affects humans and monkeys. It causes high fever, severe headache, muscle pain, and haemorrhages, with a substantial mortality rate.

Diagnosis:

- **Serological tests:** ELISA for IgM and IgG antibodies.
- **Molecular tests:** RT-PCR for detecting viral RNA.

Medication:

- No specific antiviral treatment. Management involves supportive care to alleviate symptoms.
- **Supportive Care:** Hydration, pain management, and treatment of secondary infections.
- **Vaccine:** Available and recommended for people living in or visiting endemic areas. The vaccine is administered in two doses, with a booster dose after 6-9 months.

4. Lyme Disease

Pathogen: *Borrelia burgdorferi*

Vector: *Ixodes* ticks

Significance: While less common in India compared to other regions, Lyme disease presents with symptoms such as fever, headache, fatigue, and a characteristic skin rash. Untreated, it can cause joint, heart, and nervous system complications.

Diagnosis:

- **Serological tests:** ELISA followed by Western Blot for confirming the presence of *Borrelia burgdorferi* antibodies.

Medication:

- **Antibiotics:** (Doxycycline, amoxicillin, or cefuroxime are commonly prescribed)
- **Late-stage treatment:** Intravenous antibiotics such as ceftriaxone for more severe cases
- **Vaccine:** Currently, no Lyme disease vaccine is available for humans. Prevention focuses on tick avoidance and prompt removal of ticks.

5. Anaplasmosis

Pathogen: *Anaplasma phagocytophilum*

Vector: Various ticks, including Ixodes

Significance: This zoonotic form affects humans similarly to animals, causing fever, headache, muscle pain, and potentially severe complications if untreated.

Diagnosis:

- **Blood smear:** Visualization of *Anaplasma* organisms in red blood cells
- **Serological tests:** ELISA or IFA for detecting antibodies
- **Molecular tests:** PCR for detecting *Anaplasma* DNA

Medication:

- **Antibiotics:** Tetracyclines (e.g., doxycycline) are the treatment of choice
- **Supportive Care:** As needed for symptomatic relief
- **Vaccine:** No vaccine is available for anaplasmosis. Prevention includes tick control and the use of tick repellents.

6. Rickettsioses (Spotted Fever Group and Typhus Group)

Pathogen: *Rickettsia* spp.

Vector: Various ticks, including *Rhipicephalus*, *Dermacentor*, and *Haemaphysalis*

Significance: These diseases cause fever, rash, headache, and, in severe cases, neurological complications and organ failure.

Diagnosis:

- **Serological tests:** IFA or ELISA for detecting *Rickettsia* antibodies.

- **Molecular tests:** PCR for detecting *Rickettsia* DNA.

Medication:

- **Antibiotics:** Doxycycline is the first-line treatment.
- **Supportive Care:** Management of symptoms and complications.

7. Q Fever

Pathogen: *Coxiella burnetii*

Vector: Although primarily transmitted through inhalation of contaminated dust, ticks like *Rhipicephalus* and *Dermacentor* can also act as vectors

Significance: Q fever causes flu-like symptoms, pneumonia, and hepatitis in humans. Chronic infections can lead to endocarditis and other severe complications.

Diagnosis:

- **Serological tests:** ELISA or IFA for detecting *Coxiellaburnetii* antibodies.
- **Molecular tests:** PCR for detecting *Coxiella* DNA.

Medication:

- **Antibiotics:** Doxycycline is the treatment of choice. Chronic cases may require combination therapy with doxycycline and hydroxychloroquine
- **Vaccine:** No vaccine is available in India. Prevention focuses on occupational safety and control measures in livestock.

8. Tularemia

Pathogen: *Francisella tularensis*.

Vector: *Dermacentor* and *Haemaphysalis* ticks.

Significance: Tularemia causes ulceroglandular symptoms, including fever, skin ulcers, and swollen lymph glands. It can also lead to more severe forms like pneumonic or typhoidal tularaemia.

Diagnosis:

- **Serological tests:** ELISA or agglutination tests for detecting *Francisella tularensis* antibodies.
- **Molecular tests:** PCR for detecting *Francisella* DNA.
- **Culture:** Isolation of the organism from clinical specimens.

Medication:

- **Antibiotics:** Streptomycin or gentamicin for severe cases. Doxycycline or ciprofloxacin for mild to moderate cases
- **Supportive Care:** Management of symptoms and complications.
- **Vaccine:** No vaccine is available for tularemia. Preventive measures focus on avoiding tick bites and controlling tick populations.

Medication:

- **Antibiotics:** Tetracycline, doxycycline, or erythromycin.
- **Supportive Care:** As needed for symptomatic relief.
- **Vaccine:** No vaccine is available for relapsing fever. Prevention includes tick control and personal protective measures.

Significance of Tick Borne Diseases

The impact of TBDs on domestic animals in India is profound:

- **Economic Losses:** Decreased productivity in livestock, such as reduced milk yield and poor weight gain in cattle
- **Animal Welfare:** Severe suffering and high mortality rates among untreated animals
- **Public Health:** The zoonotic potential of several TBDs poses risks to human health, particularly for those in close contact with infected animals

9. Relapsing Fever

Pathogen: *Borrelia* spp.

Vector: *Ornithodoros* ticks

Significance: Relapsing fever is characterized by recurring episodes of fever, headache, muscle and joint aches, and nausea.

Diagnosis:

- **Microscopy:** Identification of *Borrelia* spirochetes in blood smears during febrile episodes
- **Serological tests:** ELISA or IFA for detecting *Borrelia* antibodies
- **Molecular tests:** PCR for detecting *Borrelia* DNA.

Control and prevention

Effective control and prevention strategies are crucial in managing TBDs:

1. **Tick Control:** Regular use of acaricides to reduce tick infestations. This includes spraying, dipping, or using pour-on formulations
2. **Environmental Management:** Keeping animal housing clean and dry, and using tick repellents in high-risk areas
3. **Vaccination:** Development and use of vaccines, particularly for

Theileriosis, which has seen some success in India

4. **Regular Monitoring:** Routine checks for ticks and prompt removal to prevent disease transmission

Conclusion

Tick-borne diseases present a significant challenge for domestic animal health in India. By understanding the etiologies, pathology, and significance of these diseases, and implementing effective control and prevention measures, it is possible to mitigate their impact. Continued research and awareness are essential to protect India's valuable livestock and ensure the well-being of animals and humans alike.