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Trypanosomiasis or Surra in livestock animal

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Introduction:

Trypanosomiasis in livestock animals is a disease complex caused by various species of protozoan parasites belonging to the genus Trypanosoma. The most widespread form of this disease in India is caused by *Trypanosoma evansi* and is commonly known as Surra. This disease is transmitted through mechanical means by biting flies like *Tabanidae*, unlike the cyclic transmission seen with Tsetse flies in Africa. Interestingly, the geographic impact of *T. evansi*-induced trypanosomiasis is broader than that of Tsetse fly-borne trypanosomiasis in Africa.The disease can affect a wide range of mammalian species; however, from both economic and zoonotic perspectives, it is particularly significant in cattle, buffaloes, sheep, goats, horses, and camels. Trypanosomiasis poses a serious threat to livestock, leading to economic losses due to morbidity, mortality, abortion, infertility, and reduced milk production. The Office International Epizooties (OIE) recognizes the disease as a List B disease of importance in horses.Moreover, trypanosomiasis is also reported in rodents caused by *T. Lewisi*, in camels as Tribersa, and in horses as Dourine caused by *T. equiperdum*.

Zoonotic Importance:

Trypanosomiasis in humans is predominantly found in Africa, Central, and South America. In Africa, Trypanosoma brucei causes sleeping sickness, while in Central and South America, *T. cruzi* causes Chagas disease. While rare, there have been a few reported cases of accidental transmission of animal trypanosomiasis to humans in Asia. Since 2004, three cases of human trypanosomiasis have been documented in Maharashtra, India.The first case, reported in October 2004, involved a 45-year-old male cattle breeder from Shivni village, Chandrapur district, infected with *T. evansi*. The second case occurred in September 2006, with a three-month-old child from Mumbai infected with *T. lewisi*. The third case involved a 55-year-old male from Paud village, Pune district, also infected with *T. lewisi*, who unfortunately succumbed to the infection. The first two cases recovered after receiving Suramin and supportive therapy.

In animals, trypanosomiasis is known as surra, characterized by a wide range of hosts and transmitted by hematophagous flies both cyclically and mechanically. This disease is prevalent in tropical countries such as India, South Africa, and the UAE.

Economic Impact:

The economic impact of trypanosomiasis on livestock in India is significant and complex, affecting farmers and rural communities in multiple ways. Trypanosoma evansi, the causative agent of surra, causes high morbidity and mortality rates in affected animals, reducing herd size and productivity. Infected livestock often suffer from reduced milk production, weight loss, and reproductive issues, leading to decreased overall productivity and profitability for farmers. The costs associated with treating trypanosomiasis, including expensive medications like diminazene aceturate and quinapyramine sulphate, contribute to financial burdens, especially with recurrent treatments due to drug resistance. Managing the disease requires labor-intensive efforts, diverting resources from other farm activities. Trade restrictions on livestock and animal products from affected regions further limit market access and income potential. Livestock farming, a key source of livelihood, is significantly impacted, affecting the socio-economic well-being of farming families. Additionally, trypanosomiasis increases susceptibility to other diseases, adding to overall disease management costs. Addressing these challenges requires comprehensive strategies to control the disease, support affected farmers, and sustain livestock productivity in India.

Morphology:

The body of trypanosomes is typically elongated and flattened, resembling a leaf, with a somewhat rounded shape and containing a vesicular nucleus housing one nucleus along with a kinetoplast positioned posteriorly to the blepharoplast. The kinetoplast holds DNA.These protozoa possess a single flagellum connected to the body by an undulating membrane. The flagellum emerges from the blepharoplast and extends anteriorly. An axoneme extends from the kinetosome of a basal granule, attached to the body by the undulating membrane, and continues as a free flagellum.

Movement of trypanosomes can range from active to sluggish. They exhibit various shapes, including round, elongated leaf-like, short and stout stumpy forms, long and slender forms, and intermediary shapes. Trypanosomes with varying shapes are termed polymorphic trypanosomes.Some trypanosomes are uniform in size, referred to as monomorphic trypanosomes.

Transmission:

Trypanosomes multiply through longitudinal binary fission, starting with division at the kinetoplast followed by the nucleus and cytoplasm.In most cases, transmission of Trypanosoma from one vertebrate host to another occurs through blood-sucking flies, particularly *Tabanus* species, which serve as vectors for cyclical transmission. This means that within these flies, the trypanosomes undergo developmental stages necessary for their life cycle to continue. Cyclical transmission is the primary mode of transmission

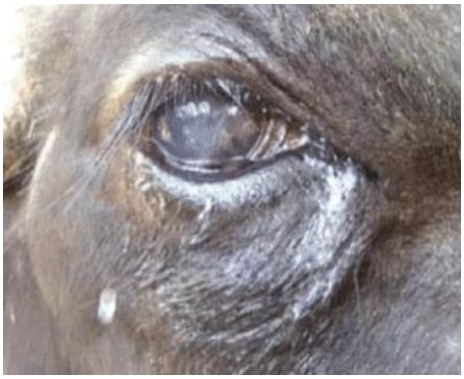

Tabanus flies

for trypanosomes between vertebrate hosts.However, there are also instances of mechanical transmission, particularly with Trypanosoma evansi, where the infective stages can survive for a brief period outside the host and require direct transfer to a new host for successful transmission. Mechanical transmission involves the transfer of infective trypanosomes by other means, such as contaminated instruments or biting flies that do not support the complete development of the parasite.Overall, transmission of Trypanosoma can occur through either cyclical (involving specific vector insects for developmental stages) or mechanical (direct transfer) means, with the specific mode varying depending on the trypanosome species and its relationship with its vector or host.

Natural hosts- Camel, horse, donkey, mule, ox, goat, pig, dog, water buffalo, elephant , mongoose , deer and other wild animals like fox, hyena and tiger.
Experimental hosts- Many laboratory animals including mouse , rat, rabbit, guinea pig and chicken.

Sign and Symptoms in Livestock:

Clinical signs of trypanosomiasis in animals include high fever (41°C), alternating between intense excitement and severe depression (coma). Affected animals may exhibit aimless circling, frequent falling down, colic, grinding of teeth, wide-eyed stare, labored and noisy breathing, head pressing against walls, apparent blindness, stamping of feet, groaning, excessive salivation, muscle twitching, followed by partial loss of senses and prostration. Parasitemia leads to high levels of trypanosomes in the blood, occluding cerebral capillaries, potentially resulting in death within 18 hours to 3 days. Sudden death can occur rapidly, mimicking poisoning, snakebite, or anthrax.

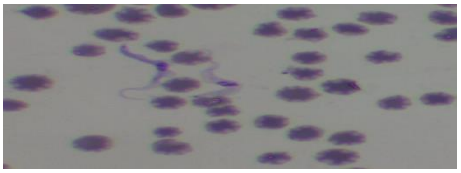


In acute cases, death can occur within 2-3 hours. Animals with the nervous form of the disease show similar symptoms. Subacute and chronic cases are characterized by dullness, sleepiness, eye watering (lacrimation), progressive emaciation, rapid pulse, intermittent fever, leg edema, diarrhea, and eventual death. Other signs include corneal opacity, twitching of facial muscles, and subnormal body temperature.

Diagnosis:

Diagnosing trypanosomiasis in livestock involves several key steps to identify and confirm the presence of the parasite:

Clinical Signs: Observing typical symptoms such as high fever, abnormal behavior (excitement alternating with depression), aimless circling, grinding of teeth, wide-eyed stare, labored breathing, and muscle twitching can raise suspicion of trypanosomiasis.



Blood Smear Examination: Taking a blood sample and examining it under a microscope for the presence of trypanosomes in the red blood cells can confirm the diagnosis. The parasites may appear as small, motile organisms within the blood.

Trypanosoma in blood smear (Giemsa stain, 400X)

Serological Tests: Using specific serological tests to detect antibodies against Trypanosoma species in the blood can aid in diagnosis, particularly in chronic or subclinical cases.

PCR (Polymerase Chain Reaction): Molecular techniques like PCR can detect and identify Trypanosoma DNA in blood samples with high sensitivity and specificity.

Early diagnosis is crucial for prompt treatment and management of trypanosomiasis to prevent severe consequences such as mortality and economic losses in livestock.

Treatment And Control:

Commonly used drugs include diminazene aceturate (berenil), quinapyramine sulphate (Antricyde sulphate), and Antricydeprosalt (a combination of quinapyramine sulphate and quinapyramine chloride). Quinapyramine sulphate is administered subcutaneously at a dose of 3-5 mg/kg body weight and is effective against surra, including strains resistant to other drugs like suramin. Antricydeprosalt, with a subcutaneous dose of 7.4 mg/kg body weight, forms a slow-release depot due to the chloride compound, providing prophylactic effects for about three months.Diminazene aceturate is given intramuscularly at a dose of 3.5 mg/kg body weight and is effective against trypanosomiasis and babesiosis, though higher doses can cause severe side effects. Its use in camels and dogs requires caution and veterinary supervision. While reports on its efficacy in buffaloes vary, diminazene remains a key treatment for trypanosomiasis.The mainstay drugs for treatment are quinapyramine sulphate and diminazene aceturate due to limited availability of other effective options like suramin and samorin. It's essential to use these drugs judiciously and at correct doses following confirmatory diagnosis to minimize drug resistance and toxicity risks. Resistance tends to develop more rapidly against prophylactic drugs compared to curative drugs, which are eliminated from the body faster.

Efforts to control trypanosomiasis by eradicating the vector, such as Tabanus flies, through mass campaigns face challenges due to the difficulty of eliminating or reducing fly populations in the environment. Currently, there are no effective vaccines available for immuno prophylaxis against trypanosomiasis.