Understanding the Transmission Dynamics of Anaplasmosis in Cattle

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ABSTRACT

Anaplasmosis, an extensive tick-borne infection, emerges from the rickettsial agent *Anaplasma marginale*, causing increased threats in subtropical and tropical areas. This disease also has zoonotic effects on humans which are very concerning. Female cattle, susceptible due to hormonal fluctuations, milk production, and breeding intricacies, confront increased infection risks, compromising immune resilience. Deep comprehension of transmission modes including biological, mechanical, and transplacental transmission is pivotal for effective control strategies, grappling with the complexity of global vector dynamics and the multifaceted nature of anaplasmosis control

Introduction:

Anaplasmosis in cattle results from the presence of *Anaplasma* (*A.*) *marginale*, a rickettsial organism. It is the most prevalent tick-borne disease and is particularly dominant in cattle living in subtropical and tropical regions, where it can cause significant morbidity and mortality in susceptible animals (1). The geographic distribution of this disease depends upon the presence of its vector along with its reservoir host (2). This disease is also zoonotic so we should deal with this disease carefully. This infection affects females more than males (3). There are three types of transmissions.

1. Biological Transmission

In cattle *Ixodidae* family (hard tick) of the ticks transmits *A. marginale*. Majorly involved genera are *Riphicephalus, Dermacentor, Ixodes,* and *Hyalomma*. *A. marginale* replicates in the midgut of the tick from where it moves to the salivary gland. When the tick sucks blood from the host it leaves anaplasma in the blood of the host. *Riphicephalus* species are major vectors of *A. marginale* in Australia and Africa. Their prevalence in Pakistan is low as compared to other ticks. Among all the species *Riphicephalus* (*R.*) *microplus* is one of the major species that transfer the anaplasmosis. *R. microplus* is a one-host tick which means it spends its whole life on a single-host species. Because of the migratory role of the male ticks they transmit disease from infected to healthy animals more often. Anaplasma shows transtadial and intrastadial transmission in ticks. It is also seen that *A. marginale* shows transovarial transmission in *R. microplus* (4). *Dermacentor* species are major vectors of *A. marginale* in USA. *Dermacentor* is a three-host tick. *A. marginale* transmits transcardially but does not show transovarian route of transmission. *Dermacentor* (*D.*) *andersoni* female get infected at the nymph stage and transmit the infection on the 6th to 7th day of feeding on the host. On the other hand, males transmit the infection within 24 hours (5). *Ixodes* are present all around the world but found particularly in the Northern and Eastern Midwest of the USA and in Southeastern Canada. It is also a three-host tick. Transmission through these ticks is less as compared to *Riphicepalous* and *dermacentor*. *A marginale* is transmitted transcardially in *ixodes*. The ticks of *Hyalomma* genus are present near Pak-Iran border and their surrounding areas and they have the highest prevalence for transmitting *A. marginale* in cattle in Pakistan.

2. Mechanical Transmission

a. Transmission through Blood Sucking Flies

Blood-sucking flies in the family <u>*Tabanidae*</u> and *Muscidae* act as a vector for the transmission of anaplasmosis. Mechanical transmission of *A. marginale* by Horse fly and Stable fly is seen in the USA. When they suck the blood from infected animals their external mouthparts get contaminated with infected blood and when they move to another host the contaminated blood from their mouthparts moves into the body of the host. Horse flies can transfer the disease for up to two hours after feeding on an infected animal (7). In areas where ticks are lesser in number, like in Uruguay, horseflies could be the important vector for *A. marginale*. So for the confirmation, in Uruguay, eight horsefly species were tested (*Dasybasis missionum, Poeciloderas lindneri, Tabanus campestris, T. claripennis, T. fuscofasciatus, T. platensis, T. tacuaremboensis* and *T. triangulum*). Four species were found to be positive for *A. marginale*, with *D. missionum and P. lindneri* having the highest number of infections, while only one individual each of *T. fuscofasciatus* and *T. tacuaremboensis* was positive. Both *D. missionum* and *P. lindneri* were positive for *A. marginale* in areas where ticks are less (6). Stable flies can transmit that particular strain of *A. marginale* in cattle. A study of dairy cows in Costa Rica shows that *Tabanidae* and stable fly are important in the transfer of *A. marginale* (13).

b. Transmission through blood contaminated equipment's

Equipment's like vaccination needles which plays important role in the transmission of the pathogen. Other examples include the use of dehorner, and other surgical instruments. Transferring blood from an infected or reservoir animal can cause anaplasmosis (7).

3. Transplacental Transmission

This type of transmission occurs when the pathogen is transmitted from dam to fetus. It occurs in the second and third trimester of the pregnancy. A study in Brazil shows that 10 percent of calves born to infected mother were infected with anaplasmosis (8). According to another study 16 percent of calves were born infected (9).

Conclusion

In conclusion, to control anaplasmosis (the most prevalent tick-borne disease) we have to overcome the routes of its transmission. To this end, we must use sterilized surgical instruments and apply acaricides. Other than that, management practices at farms must be improved for example closure of cracks and crevices. To control flies, we should keep the nearby places clean so that larvae of flies cannot get a suitable environment for their growth

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