Review of current anaplasmosis control strategies and future directions

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Abstract

Anaplasma marginale, causative agent of bovine anaplasmosis, is the most prevalent tick-transmitted disease of cattle worldwide and a major obstacle to profitable beef production. Bovine anaplasmosis control strategies rely upon the use of vector control, vaccination, and tetracycline antimicrobials. This article reviews transmission as well as current and future directions for control.

Key words: anaplasmosis, transmission

Résumé

Anaplasma marginale, l'agent responsable de l'anaplasmose bovine, est la maladie transmise par les tiques la plus commune chez les bovins du monde entier et représente une menace sérieuse à la rentabilité de la production de bœuf. Les stratégies de contrôle de l'anaplasmose bovine reposent sur le contrôle des vecteurs, la vaccination et les antimicrobiens comme la tétracycline. Cet article fait le point sur la transmission et sur les orientations présentes et futures du contrôle.

Objectives

1. Understand the current status of bovine anaplasmosis in the United States.
2. Review the modes of transmission of bovine anaplasmosis.
3. Review current anaplasmosis control methods.
4. Discuss the role CTC in anaplasmosis control in Kansas.

History and Significance

Anaplasma marginale (Am) was first reported in South Africa by Sir Arnold Theiler when he identified organisms as "marginal points" on the red blood cells of cattle.[5] However, *Am* was not identified in the United States (US) until 1926.[5] The first case of *Am* was reported by a Kansas practitioner that identified a devastating anemic condition in dairy cattle.[1,5] Since that time, *Am* has become endemic in the southern US. and has been identified in nearly every state.[6] Bovine anaplasmosis is the most prevalent tick-transmitted disease of cattle worldwide and a major obstacle to profitable beef production. In the US, bovine anaplasmosis is conservatively estimated to cost the cattle industry >$300 million per year.

Epidemiology/Transmission

Anaplasma marginale is a hemoparasite of wild and domestic ruminants that is transmitted biologically by ticks and biting flies and mechanically by blood-contaminated fomites.[2,3,7] Route of transmission is highly variable with regards to geographic region.

Tick Transmission

In the US, tick transmission of *Am* is predominantly due to intrastadial (within the same life stage) transmission by adult male ticks.[2,3,10] The juvenile stages of *Dermacentor variabilis* and *Dermacentor andersoni* DO NOT feed on deer or cattle, therefore, the only tick life stage that is potentially exposed to *Am* is the adult stage.

Important tick transmission considerations:

1. Female ticks are not important in transmission of *Am.*
2. *Am* is not transmitted to offspring, so juvenile stages are not important for transmission of *Am.*
3. Adult male *D. variabilis* and *D. andersoni* ticks can acquire *Am* when feeding on an infected host.

In general, ticks won't move more than 3 meters from where they fell off the last host and are very susceptible to desiccation. Therefore, perimeter control and maintaining UV exposure to pastures/pens is a great way to control ticks. If another animal (e.g. deer) enters a pasture/pen and a tick falls off, then that tick has already completed its bloodmeal and will not feed again. These detached ticks will seek out (within 3 meters) a protected spot to molt to the next life stage which will make an appearance the following year. A well-maintained pasture/pen does not offer much in the way of protected spaces for ticks to successfully molt.

Biting Fly Transmission

Stable and horse flies have both been implicated as mechanical vectors for transmission of *Am.* Flies are not capable of propagating the organism. The scientific literature has shown that the efficiency with which a fly can transmit *Am* is directly proportional to the bacteremia of the animal that the fly feeds on and the distance from the nearest naïve animal.[8,9]

Control

The only approved antimicrobial treatments for bovine anaplasmosis in the US are tetracycline antimicrobials. There are currently no antimicrobials labeled for the elimination of persistent *Am* infection in carrier animals. Alternative strategies to control anaplasmosis include: maintenance of *Am*-free herds, immunization against *Am*, and intensive vector control; however, these strategies are largely impractical or not efficacious. In the absence of approved vaccines and ineffective *Am* control alternatives, anaplasmosis control in endemic areas is predicated on administration of low doses of chlortetracycline (CTC), usually supplied in mineral supplements for several months or longer. There are currently 4 US Federal Drug Administration (FDA)-approved free-choice CTC-medicated mineral formulations (700, 5,000, 6,000, 8,000 g/ton). Our research group has been particularly interested in determining the effect of continuous feeding of the 4 FDA approved CTC medicated mineral formulations on anaplasmosis status of cows in endemic *Am* regions of the US.

References/Resources

1. Darlington PB. Anaplasmosis in cattle (Galziete) found to exist in Kansas. *N AM Vet* 1926;7:39-41.
2. Ewing S. Transmission of Anaplasma marginale by arthropods. 7th National Anaplasmosis Conference 1981;395-423.
3. Kocan KM, Barron SJ, Ewing SA, Hair JA. Transmission of Anaplasma marginale by adult Dermacentor andersoni during feeding on calves. *Am J Vet Res* 1985;46:1565-1567.
4. Kocan KM, Blouin EF, Barbet AF. Anaplasmosis control. Past, present, and future. *Ann N Y Acad Sci* 2000;916:501-509.
5. Kocan KM, de la Fuente J, Blouin EF, Coetzee JF, Ewing SA. The natural history of Anaplasma marginale. *Vet Parasitol* 2010;167:95-107.
6. Kocan KM, de la Fuente J, Step DL, Blouin EF, Coetzee JF, Simpson KM, Genova SG, Boileau MJ. Current challenges of the management and epidemiology of bovine anaplasmosis. *Bov Pract* 2010;44:93-102.
7. Kocan KM, Goff WL, Stiller D, Claypool PL, Edwards W, Ewing SA, Hair JA, Barron SJ. Persistence of Anaplasma marginale (Rickettsiales: Anaplasmataceae) in male Dermacentor andersoni (Acari: Ixodidae) transferred successively from infected to susceptible calves. *J Med Entomol* 1992;29:657-668.
8. Scoles GA, Broce AB, Lysyk TJ, Palmer GH. Relative efficiency of biological transmission of Anaplasma marginale (Rickettsiales: Anaplasmataceae) by Dermacentor andersoni (Acari: Ixodidae) compared with mechanical transmission by Stomoxys calcitrans (Diptera: Muscidae). *J Med Entomol* 2005;42:668-675.
9. Scoles GA, Miller JA, Foil LD. Comparison of the efficiency of biological transmission of Anaplasma marginale (Rickettsiales: Anaplasmataceae) by Dermacentor andersoni Stiles (Acari: Ixodidae) with mechanical transmission by the horse fly, Tabanus fuscicostatus Hine (Diptera: Muscidae). *J Med Entomol* 2008;45:109-114.
10. Stich RW, Kocan KM, Palmer GH, Ewing SA, Hair JA, Barron SJ. Transstadial and attempted transovarial transmission of Anaplasma marginale by Dermacentor variabilis. *Am J Vet Res* 1989;50:1377-1380.