EHRlichiosis

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<td>Mammals</td>
<td>Mechanical, via vectors (tick-borne)</td>
<td>Non-specific: fever, depression, lethargy, thrombocytopenia, anemia, weight loss muscle/joint pain, lymphadenopathy, hepatocellular enzyme abnormalities</td>
<td>Subclinical or mild illness to severe, potentially fatal disease</td>
<td>Tetracycline antibiotics (doxycycline)</td>
<td>Tick control, screened blood donors, inspect animals frequently in tick-infested areas</td>
<td>Yes</td>
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Fact Sheet compiled by: Danielle R. Graham Snyder and Dawn Zimmerman

Sheet completed on: 22 March 2011; updated 25 September 2012

Fact Sheet Reviewed by: Melissa Kennedy, Stephanie Kottler

Susceptible animal groups: Mammals (reported in humans, dogs, coyotes, wolves, foxes, cats, cattle, sheep, goats, horses, llamas, deer, elk, and rodents)

Causative organism:
Tick-borne bacteria (rickettsia): small, Gram-negative, pleomorphic, obligate intracellular cocci that infect different blood cells in various animals, including humans.
- *Ehrlichia chaffeensis* (human monocytic ehrlichiosis), known reservoirs include white-tailed deer and dogs.
- *Ehrlichia ewingii* (canine granulocytic ehrlichiosis, CGE), known reservoirs include white-tailed deer and dogs.
- *Ehrlichia canis* (canine monocytic ehrlichiosis, CME), known reservoirs include dogs.
- *Ehrlichia ruminantium*, known reservoirs include ruminants.
- *Ehrlichia muris*, known reservoirs include wild small rodents.
- Other (new *Ehrlichia* spp. that closely resembles *E. muris*)

Note: *Ehrlichia risticii* has been reclassified as *Neorickettsia risticii* and *Ehrlichia platys* as *Anaplasma platys*. *Ehrlichia equi*, *Ehrlichia phagocytophilia*, and Human Granulocytic Ehrlichial Agent are now considered to be the same species and have been reclassified as *Anaplasma phagocytophilum*.

Zoonotic potential: Yes, via vectors or mechanical transmission.

Distribution: Almost every state in the US has reported a case of ehrlichiosis. Generally in southern, eastern, and south-central US, *E. canis* predominates and in southwest US, it is mainly transmitted by the brown dog tick *Rhipicephalus sanguineus*. *E. ewingii* is found predominantly in southern and mideastern US and mainly transmitted by the lone star tick *Amblyomma americanum*; *E. chaffeensis* predominantly in the southeastern US and is the most common ehrlichiosis in Georgia and is transmitted primarily by the lone star tick. *Ehrlichia* has been reported in South America, Asia, Africa, and Europe.

Incubation period:
Humans: 5-10 days after a tick bite.
Dogs: 8-20 days.

It is estimated that the infected tick must be attached to the host for 24-48 hours for transmission to occur.
**EHRLICHIOSIS**

*Ehrlichia* can remain alive in the developing tick for up to 5 months. Acute infection develops 1-3 weeks after transmission and lasts ~2-4 weeks. After ~6-9 weeks, the organism is eliminated in an immunocompetent animal or a parasitemia develops with no clinical signs in the subclinical phase which can last from weeks to years or mild to severe clinical signs. If the animal cannot mount an effective immune response, the animal becomes chronically infected.

**Clinical signs:** Generally non-specific, multi-systemic: fever, depression, lethargy, thrombocytopenia, anemia, anorexia, weight loss, lymphadenopathy; hepatocellular enzyme abnormalities, possibly gastrointestinal signs (vomiting, diarrhea), polymyositis, polyarthritis, rash, ocular signs (uveitis or retinal petechiae), reproductive disorders, and neuropathies.

Clinical signs depend on the strain of *Ehrlichia*, dose of infection, species, immunological status of host, and concurrent infections with other tick-borne parasites.

In dogs, the **acute phase** is generally mild and causes immune-mediated platelet destruction and manifesting in lethargy, anorexia, lymphadenopathy, fever, and is often associated with the presence of ticks. In the **subclinical phase**, dogs appear normal with a somewhat reduced platelet count and elevated globulin levels; this phase can last months to years. In the **chronic phase**, clinical signs recur with up to 60% of infected dogs presenting with abnormal bleeding due to reduced platelet numbers; elevated globulin levels are almost always seen; uveitis, neurological effects, and glomerulonephritis can also result; most dogs do not show full pancytopenia. Infections with *E. ewingii*, which primarily causes disease in the immunocompromised, tend to additionally produce arthritis.

**Post mortem, gross, or histologic findings:**

Gross: splenomegaly, hepatomegaly, and lymphadenopathy during acute phase.

Histologic: extensive plasma cell infiltration of parenchymal organs; perivascular cuffing particularly of the lungs, kidneys, spleen, meninges, and eyes.

**Diagnosis:**

- History of exposure and clinical signs (diagnosis of subclinical disease based on anamnesis, geographic location, persistent antibody titers, mild thrombocytopenia, and hypergammaglobulinemia).
- Morulae (intracytoplasmic bacterial aggregates) in monocytes on blood and buffy coat smears (Romanowsk stain); however, often only seen in a small percentage of blood smears of infected dogs, and only found in the bloodstream for a few days in the acute stage.
- Enzyme-Linked Immunosorbent Assay (ELISA), e.g. IDEXX “snap 4DX” (includes Lyme disease and heartworm tests; detects *E. canis*, not *E. ewingii*) - not quantitative.
- Detection of *E. canis* serum antibodies with indirect Immunofluorescence Antibody Test (IFA), antibodies can be detected as early as 7 days post-infection, although animals may not be seropositive until 28 days post-infection. It takes 6-9 months after infection for titers to drop. Serologic cross-reactions may occur with other rickettsial agents.

With ELISA and IFA, a positive test only indicates exposure and does not imply active infection. A titer >1:80 is considered positive. If <1:80, considered suspect and should retest in 2-3 weeks (titers will increase rapidly in the acute stage, look for four-fold increase between paired serum samples or test again using PCR or Western blot). IFA and ELISA tests detect *Ehrlichia* species other than *E. canis*.

- Polymerase Chain Reaction (PCR, e.g. Antech FastPanel™ PCR Canine Ehrlichiosis/Anaplasmosis Profile for *E. canis*, *E. chaffeensis*, and *E. ewingii*, cross-reacts with *Anaplasma*). PCR can detect *E. canis* in dogs within 4-10 days of exposure, before they become seropositive. PCR remains positive for several weeks after infection has cleared, as it does not distinguish between live and dead organisms. Peptide and recombinant antigens are available for *E. ewingii*; however, CGE diagnosis is usually made via visualization of morulae within neutrophils, PCR, ELISA, or Western immunoblot.
**EHRLICHIOSIS**

- Western immunoblot
- Demonstration of ehrlichial antigen in tissue sample by immunohistochemical methods, or *in situ* hybridization.
- Isolation of ehrlichial species from a clinical specimen in cell culture.

**Material required for laboratory analysis:**
Serology: serum taken within first week of illness, with second sample taken 2-3 weeks later. Retain acute-phase serum sample and submit two samples together at same time.
PCR: 0.5ml whole blood (EDTA), or biopsy specimens from organs such as lymph nodes, spleen, liver, or bone marrow
Sample blood prior to starting antimicrobial therapy to avoid false negative test results.

**Relevant diagnostic laboratories:**
Antech (FastPanel PCR Canine Ehrlichiosis/Anaplasmosis Profile) and Zoologix (PCR, two tests: one is *E. canis* specific, other detects but does not differentiate most common *Ehrlichia* species). PCR panel for tickborne diseases which includes common *Ehrlichia* species.
NCSU diagnostic PCR–https://www.cvm.ncsu.edu/vth/ticklab.html
OSU diagnostic PCR and serology- http://riki-lb2.vet.ohio-state.edu/ehrlichia/

**Treatment:** Tetracycline antibiotic for at least one month - usually doxycycline which allows for a more convenient dosing schedule. Dramatic initial improvement usually observed within 24-48 hours. Treatment success should be based on remission of clinical signs, decline in *E. canis* antibody titers, and concurrent decrease in gamma globulins. Imidocarb is sometimes used in conjunction with antibiotics. With severe disease, blood transfusions or intravenous fluids may be necessary. Corticosteroids (prednisone) can be used to palliate immune-mediated secondary reactions such as immune-mediated arthritis or platelet loss. Generally, the prognosis during the acute phase is good if the animal is treated properly. Animals in the chronic stage have a poorer prognosis.

**Prevention and control:** To prevent exposure, exposure to ticks should be limited and use of repellents (permethrin) considered. Animals should be examined for ticks in tick-infested areas and at peak time of year (April through September). Vegetation can be modified to discourage tick and wild host habitation. Seronegative blood donors should be used for transfusions.

**Suggested disinfectant for housing facilities:** Area-wide application of acaricides and removal of leaf litter and brush are effective. Consider least-toxic pesticide for use on targeted barriers.

**Notification:** Not required

**Measures required under the Animal Disease Surveillance Plan:** Currently none

**Measures required for introducing animals to infected animal:** Animals may be carriers but ticks are still needed for transmission. Note that transmission can occur through a blood transfusion when the donor is infected.

**Conditions for restoring disease-free status after an outbreak:** Tick control in the environment is essential. Infected ticks can transmit the disease for 155 days, and after treatment, an animal is still susceptible to re-infection with the same, or another *Ehrlichia* species. However, short-term protection has been described with some *Ehrlichia* infections, waning after about one year. For example, prophylactic administration of tetracycline at a lower dose is effective in preventing *E. canis* infection in situations where disease is endemic. Treatment must be extended for many months through at least one tick season if the endemic cycle is to be successfully eliminated.

**Experts who may be consulted:**
Dr. Anthony Barbet
Dept Infectious Diseases & Pathology
## References:


