

Equine Granulocytic Anaplasmosis: A Case Report and Review

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ABSTRACT

A 15 year-old Thoroughbred mare was examined for lethargy, fever, and inappetence of 1-day duration. A hard-bodied tick was removed from the horse. A complete blood count (CBC) demonstrated leukopenia with lymphopenia and thrombocytopenia. Morulae were visualized in circulating granulocytes. A polymerase chain reaction (PCR) confirmed the identity of these organisms as *Anaplasma phagocytophilum*. The horse was treated symptomatically for fever and inappetence with flunixin meglumine (1.1 mg/kg [0.5 mg/lb]) and oral electrolyte paste. Oxytetracycline (6.6 mg/kg [3 mg/lb] intravenously every 24 hours) treatment was begun as soon as a definitive diagnosis was determined. The mare responded to treatment, but she was switched to oral doxycycline (10 mg/kg [4.5 mg/lb] every 12 hours) after 5 days because of perivascular swelling at the injection site. Complete resolution of clinical signs was seen. There was no evidence of recurrence 1 year later. No additional horses at the farm were affected. The horse in this report presented for lethargy, inappetence, and fever, with limited other abnormalities. This represents a classical presentation of a mild to moderate case of anaplasmosis, which had not previously been reported in Virginia. The disease may be more widespread than has been previously reported, and it should warrant inclusion on a complete differential diagnosis list in a case of fever of unknown origin.

Keywords: Anaplasmosis; Ehrlichiosis; Tick-borne disease; Fever; Thrombocytopenia

INTRODUCTION

The mare in this report presented with classic signs of infection with *Anaplasma phagocytophilum*: fever, lethargy, and

inappetence, with a thrombocytopenia and inclusion bodies within neutrophils noted on an initial complete blood count (CBC). Equine granulocytic anaplasmosis is one of a number of rickettsial diseases that affect horses. The first cases of infection with the causal bacterium were observed in northern California in the late 1960s.¹ Since these initial reports, the disease has been reported in Arkansas, Colorado, Connecticut, Florida, Illinois, Minnesota, Pennsylvania, and Washington. Outside of the United States of America, it has also been confirmed in British Columbia, Sweden, Great Britain, Germany, and South America. To our knowledge, this is the first published report of a case in Virginia, and it illustrates the spread of tick-borne diseases across the continental United States, thus warranting their inclusion in a complete differential diagnosis list.

CLINICAL REPORT

A 15-year-old Thoroughbred mare presented to the ambulatory service in late November for a 1-day history of fever, inappetence, and lethargy. On examination, the horse was febrile (103.6°F), anorectic, and hypodyspic, although she did not appear clinically dehydrated. A hard-bodied tick was removed from the submandibular region. The horse was kept at a boarding facility with other horses, none of which were showing any signs of illness. The mare was sedated with xylazine (Sedazine, Fort Dodge Animal Health, Fort Dodge, IA; 0.3 mg/kg [0.14 mg/lb] intravenously) to facilitate examination per rectum. Tachypnea was noted after sedation. Palpation per rectum did not reveal any abnormalities other than a normal quantity of mucus-covered, hard fecal balls that were removed from the rectum during examination. Similar fecal balls were present in the small colon.

Nasogastric intubation was performed; no reflux was present. Six liters of water and 2 L of mineral oil were given to lubricate the passage of fecal matter. When the tube was removed, epistaxis from the left nostril occurred. The rate and volume of epistaxis was mild, but resolution of epistaxis seemed prolonged (40 minutes). Blood was drawn from the jugular vein for a CBC and chemistry panel.

Symptomatic treatment to reduce the fever and to encourage the horse to resume normal eating and drinking was begun. The mare was given one dose of intravenous

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flunixin meglumine (Banamine, Schering-Plough Animal Health, Union, NJ; 1.1 mg/kg [0.5 mg/lb]), and the owner was instructed to continue giving oral flunixin meglumine paste at 1.1 mg/kg every 12 hours for the next 3 days. Feeding instructions were to offer free choice hay, but no grain, for the next 24 hours, and to provide continual access to fresh water and to a trace mineral block. An oral electrolyte paste was dispensed to encourage the horse to drink and to help correct mild abnormalities that were potentially present because of reduced nutritional intake. The collected blood samples were then delivered to the Veterinary Teaching Hospital clinical pathology laboratory for analysis.

Hemogram results indicated a leukopenia, $4.91 \times 10^3/\mu\text{L}$ (reference interval [RI], $5.40\text{--}14.30 \times 10^3/\mu\text{L}$), with a lymphopenia, $0.884 \times 10^3/\mu\text{L}$ (RI, $2.19\text{--}5.90 \times 10^3/\mu\text{L}$), a thrombocytopenia, $48.3 \times 10^3/\mu\text{L}$ (RI, $100.00\text{--}350.00 \times 10^3/\mu\text{L}$), and hyperfibrinogenemia, 700 mg/dL (RI, 100–400 mg/dL). Mean corpuscular hemoglobin concentration was slightly increased at 37.8% (RI, 33.6%–36.5%).

On review of the CBC by a pathologist, single 2- to 4- μm round, pale basophilic, morulae-like cytoplasmic inclusion bodies were seen within several of the circulating neutrophils (Fig. 1). These inclusions were morphologically compatible with *Anaplasma phagocytophilum* infection. To confirm a diagnosis of *A. phagocytophilum*, and because the disease had not been previously diagnosed in an equid by our laboratory or within the state of Virginia, an ethylenediaminetetra-acetic acid blood sample from the initial visit was sent, along with slides that demonstrated inclusion bodies, to an external laboratory (Tick Borne Disease Lab, Raleigh, NC) for polymerase chain reaction (PCR) confirmation. Positive PCR results for *Anaplasma phagocytophilum* were later received.

The serum biochemistry panel revealed minor electrolyte and biochemical disturbances. There was a slight decrease in urea nitrogen, 14 mg/dL (RI, 17–28 mg/dL); phosphorus, 1.8 mg/dL (RI, 2.0–4.1 mg/dL); calcium, 11.0 mg/dL (RI, 11.4–13.4 mg/dL); magnesium, 1.1 mg/dL (RI, 1.5–2.2 mg/dL); and sodium, 130 mEq/L (RI, 132–138 mEq/L). An increased total bilirubin, 4.3 mg/dL (RI, 0.7–1.7 mg/dL), was also demonstrated. A low total carbon dioxide concentration, 23 mEq/L (RI, 28–36 mEq/L), and a high anion gap, 2.5 (RI, 1.0–9.0), were the final abnormalities. Most of the serum biochemical abnormalities can be explained by the 1- to 2-day history of reduced nutritional intake progressing to anorexia. They were interpreted as such in this case. An increased anion gap and reduced total carbon dioxide indicated the presence of a titration acidosis compatible with the presence of lactic acidosis (dehydration and anaerobic glycolysis) or ketonemia (starvation).²

After PCR confirmation of the inclusion bodies' identity within granulocytes, a clinical diagnosis of infection with *A. phagocytophilum* was made. Due to a holiday weekend,

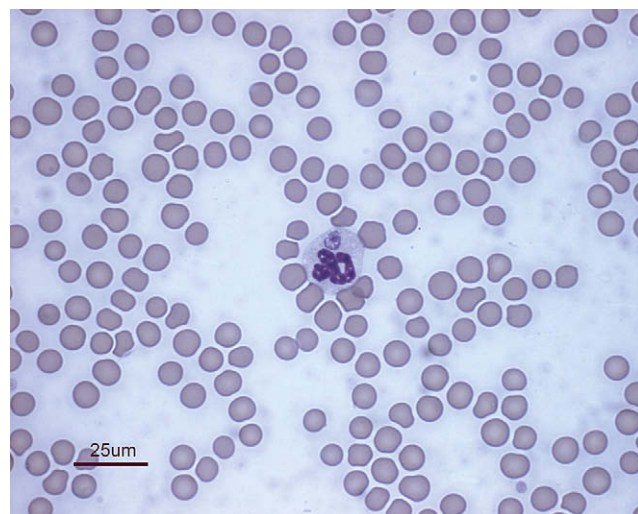


Figure 1. A photograph of a blood smear from the horse's initial CBC, demonstrating leukopenia and the presence of an inclusion body, characteristic for infection with *A. phagocytophilum*, in a circulating neutrophil. Original magnification 100 $\times$.

3 days had elapsed between the initial visit and examination of the blood smear by a clinical pathologist. Over this time the mare's fever was well controlled with flunixin meglumine, and she began to eat small quantities of hay, although she was not offered grain. Normal feces were passed at a normal frequency. Some degree of lethargy was still apparent. A return visit to the farm was immediately scheduled once a definitive diagnosis was reached.

On examination, the mare had a rectal temperature of 98.9°F. Results of a repeat physical examination were normal. No other horse had shown similar symptoms. Another CBC was performed to assess progression of the previously noted abnormalities. The mare was given oxytetracycline (BioMycin 200, Boehringer Ingelheim Animal Health, St. Joseph, MO) at 6.6 mg/kg (3 mg/lb), diluted in 250 mL of sterile saline and given intravenously into the left jugular vein. Nonsteroidal anti-inflammatory drugs (NSAIDs) (oral flunixin meglumine at 1.1 mg/kg [0.5 mg/lb]) were continued for an additional 2 days to limit the inflammatory response to the parasite.

The second hematological evaluation revealed a return to normal reference ranges for the values that had previously been low. Platelet counts had normalized at $160 \times 10^3/\mu\text{L}$, and all white cell values were within RI. The plasma fibrinogen level was still mildly elevated at 500 mg/dL, although this represented an improving trend towards normal. No inclusion bodies were visualized in the granulocytes of this sample.

Administration of oxytetracycline at 6.6 mg/kg (3 mg/lb) intravenously every 24 hours was continued for 5 days. Physical examinations were performed daily at each treatment, and

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