Table 1. Ketamine Stun 5 mL Stock Solution for Standing Restraint

Drug	Amount
Ketamine (100 mg/mL solution)	1 mL
Small-animal[a] xylazine (20 mg/mL solution)	2 mL
Butorphanol (10 mg/mL solution)	2 mL
Dosing	
Docile (dairy) cattle	1 mL/400 kg (880 lbs)
Fractious (beef) cattle	1 mL/200 kg (440 lbs)
Speed of Onset: IV > IM > SC	
Duration of effect: SC > IM > IV	
Risk of recumbency: IV > IM > SC (high dose > low dose)	

IM=intramuscular; IV=intravenous; SC=subcutaneous.

[a]Because of concentration differences, it is important to use the small-animal formulation of xylazine for this stock solution, not the large-animal formulation.

xylazine 0.05 mg/kg IV is administered first followed by ketamine 2 mg/kg IV (20×standing stun) once sedated. In cases where longer anesthesia is required, the combination of xylazine 0.05 to 0.1 mg/kg intramuscularly (IM) and ketamine 4 mg/kg IM provides 30 to 40 minutes of recumbency. Animals do not need to be fasted before the standing stun or recumbent stun, but should be fasted 24 to 48 hours before anesthesia.

Dr. Coetzee also provided some alternatives to xylazine alone. Romifidine 0.05 mg/kg can be used for recumbency in sheep and a dose of 2 to 3 mg IV provides excellent standing restraint in adult cows. Detomidine 2.5 to 10 µg/kg IV provides sedation and recumbency in cattle lasting 30 to 60 minutes. Medetomidine at a dose of 30 µg/kg IM produces recumbency in calves and a dose of 10 µg/kg IV produces recumbency in sheep for approximately 1 hour.

The acidic properties of lidocaine produce a painful injection in animals. Because of this, Dr. Coetzee highly recommends the use of lidocaine buffered with sodium bicarbonate, using a 10:1 ratio of 2% lidocaine to a commercially available 8.4% sodium bicarbonate solution. This practice is supported by published reports that buffered lidocaine reduces injection pain [McKay et al. *Anes Analg* 1987], may enhance analgesia [Curatolo M et al. *Anes Analg* 1998], and may reduce nerve block onset time [Sinnott CJ et al. *Anethesiology* 2000].

Diagnosis and Treatment of Tick-Borne Diseases in Horses

Written by Toni Rizzo

Clinical recognition of tick-borne diseases can be a challenge, because tick–horse interactions are not as well studied as tick interactions with humans and dogs. In addition, clinical signs of equine tick-borne diseases are nonspecific. Julia H. Wilson, DVM, Turner Wilson Equine Consulting, Stillwater, Minnesota, USA, discussed tick identification, characteristics of equine tick-borne diseases, and strategies for prevention and tick avoidance.

Ticks can carry the agents of 3 important equine infectious diseases in North America: anaplasmosis, borreliosis (Lyme disease), and piroplasmosis. The most common ticks found on horses are the black-legged tick (*Ixodes scapularis*) and Western black-legged tick (*Ixodes pacificus*), also known as deer ticks, and the American dog tick (*Dermacentor variabilis*). Both *Ixodes* species transmit anaplasmosis and Lyme disease, but *D. variabilis* is not an important transmitter of disease in horses. *Dermacentor nitens* and *Amblyomma cajennense* have been implicated in equine piroplasmosis transmission.

Tick-borne diseases are transmitted when nymphs and adults attach to a host and feed on blood. A tick needs to stay attached for 12 hours to transmit disease. Nonspecific signs that might suggest a tick-borne disease include fever, lethargy, weakness, limb edema, edema under the abdomen, poor appetite, and the presence of ticks. Making a differential diagnosis involves a physical examination; tick identification; a review of associated factors, including the herd history, vectors, exposure, age, and breed; and laboratory tests.

Equine anaplasmosis, also known as ehrlichiosis, is caused by *Anaplasma phagocytophilum*, primarily transmitted by *Ixodes*. Reservoirs include rodents and deer. *A. phagocytophilum* also infects humans and other animals. Incubation takes from 1 to 9 days. The diagnosis is made on the clinical signs and identification of the organism (Table 1).

Most horses recover from anaplasmosis in 1 to 4 weeks with antibiotic treatment. The most effective is intravenous oxytetracycline. Oral doxycycline is another option. Supportive care includes limb bandages, easily chewed food, and nonsteroidal anti-inflammatory drugs (NSAIDs) for fever.

Lyme disease is caused by the spirochete bacteria, *Borrelia burgdorferi*, transmitted primarily by *Ixodes* species. Clinical signs are widely variable (Table 1). Diseases with similar symptoms include anaplasmosis,

Table 1. Diagnosis of Anaplasmosis, Lyme Disease, and Piroplasmosis

Disease	Signs and Symptoms	Diagnostic Tests
Anaplasmosis (*Anaplasma phagocytophilum*)	▪ Fever for 1–12 days ▪ Depression ▪ Loss of appetite ▪ Limb edema ▪ Petechia ▪ Icterus ▪ Ataxia or cranial nerve deficits ▪ Myositis ▪ Colic ▪ Orchiditis ▪ Neutropenia, mild anemia, thrombocytopenia	▪ Identification of morulae in granulocyte inclusions in blood or buffy coat smear ▪ Chemistry profile ▪ Antibody test but titers slow to peak ▪ PCR
Lyme disease (*Borrelia burgdorferi*)	▪ Low-grade fever ▪ Depression, lethargy ▪ Weight loss ▪ Regional lymphadenopathy ▪ Arthritis, recurrent lameness ▪ Behavior change ▪ Neurologic disease ▪ Uveitis ▪ Abortion ▪ Cardiomyopathy	▪ Serum antibody ▪ Cornell multiplex test to identify OspA, OspC, and OspF antibodies ▪ ELISA ▪ PCR on synovial biopsy or CSF ▪ CSF lymphocytic pleocytosis ▪ Culture synovial tissue (ideal) or joint fluid ▪ Histopathology of tick bite site or regional lymph nodes
Piroplasmosis (*Babesia caballi* and *Theileria equi*)	▪ Fever ▪ Labored breathing ▪ Pale or yellow mucous membranes ▪ Ecchymoses ▪ Dark urine ▪ Gastrointestinal symptoms ▪ Splenomegaly	▪ Identification on blood smear ▪ ELISA ▪ PCR

PCR=polymerase chain reaction; CSF=cerebrospinal fluid; ELISA=enzyme-linked immunosorbent assay.

immune-mediated disease, and leptospirosis. Diagnosis is based on identification of the organism and serum antibodies. Oxytetracycline is the first choice for treatment. Alternatives include high-dose penicillin, oral doxycycline, and minocycline. NSAIDs are used to reduce inflammation. The blood antibody level falls if treatment is successful.

Piroplasmosis is a tropical protozoal disease caused by *Babesia caballi* or *Theileria equi*. It is common worldwide but not in the United States, Canada, Australia, the United Kingdom, Ireland, and Japan. Testing is required before importation into the United States. In 2009, however, an outbreak occurred in Texas in illegally imported horses, which led to ticks becoming infected and subsequently transmitting the disease to horses in at least 15 states. Diagnosis is made by identifying the organism (Table 1). Piroplasmosis is treated with intramuscular imidocarb for 2 days.

Tick-borne diseases can be prevented by daily inspection and removal of ticks from horses. Pastures should be mowed, horses kept out of woodlands, exposure to leaf litter reduced, and deer excluded from the pasture. Mice can be treated with fipronil, and their nests with permethrin. Tick repellents such as permethrin and DEET (N,N-diethyl-meta-toluamide) should be used on the horses and their riders.

Leukemia and Myeloproliferative Disorders Summarized

Written by Muriel Cunningham

Amy N. Schnelle, DVM, University of Illinois, Urbana, Illinois, USA, gave an overview of leukemia and myeloproliferative diseases in veterinary medicine. The clinical signs of leukemia can be vague and include lethargy, change in behavior, weight loss, petechiation, cytopenias, and enlarged peripheral lymph nodes or spleen. Often, these cases are detected incidentally, particularly with chronic lymphocytic leukemias (CLLs). The survival times for acute leukemias (days to months) are generally worse than for the chronic leukemias (months to years). Biochemistry results can be highly variable. Sometimes, they are normal; however, abnormalities may include hyperglobulinemia, unexplained hypercalcemia, or others related to specific organs that are affected.