## Colorado Tick Fever Virus

**Disease Agent:**

- Colorado tick fever virus (CTFV)

**Disease Agent Characteristics:**

- Family: *Reoviridae*; Genus: *Coltivirus*
- Virion morphology and size: Nonenveloped, icosahedral nucleocapsid symmetry, spherical particles, 80 nm in diameter
- Nucleic acid: Segmented, double-stranded RNA with plus and minus strands that are colinear and complementary, ~27-29 kb in length
- Physicochemical properties: Stable at –70°C, 4°C, and room temperature, but loss of infectivity is accelerated at higher temperatures; resistant to treatment with ether and other lipid solvents, relatively resistant to commonly used disinfectants (e.g., formalin, Lysol, $H_2O_2$, and phenol); Wescodyne (1:200) is of only limited efficacy; may be inactivated by 95% ethanol; sodium hypochlorite (800 mg/L) is highly effective after brief exposure; sensitive to UV light.

**Disease Name:**

- Colorado tick fever

**Priority Level:**

- Scientific/Epidemiologic evidence regarding blood safety: Very low
- Public perception and/or regulatory concern regarding blood safety: Absent
- Public concern regarding disease agent: Absent but very low in endemic areas

**Background:**

- Recognized as a distinct entity in the US in 1930
- Etiologic agent isolated from blood in 1943
- Disease range corresponds to distribution of wood tick, *Dermacentor andersoni*, in the US and Canadian Rocky Mountains, Wasatch and Sierra Nevada Ranges, and Black Hills usually between March and September.

**Common Human Exposure Routes:**

- Tick bite

**Likelihood of Secondary Transmission:**

- None

**At-Risk Populations:**

- Predominantly persons hiking, fishing, or camping in enzootic locations

**Vector and Reservoir Involved:**

- Adult wood ticks of the species *Dermacentor andersoni*
- Other tick species may carry the virus, but their roles in transmission are uncertain.

**Blood Phase:**

- The virus infects erythroblasts and prolonged intraerythrocytic viremia lasts up to several months and parallels survival of RBCs.

**Survival/Persistence in Blood Products:**

- At least 8 days as documented in the single posttransfusion case
- 18 months in refrigerated blood clots

**Transmission by Blood Transfusion:**

- One documented case transmitted by transfusion

**Cases/Frequency in Population:**

- Endemic in mountainous regions that are congruent with the distribution of the vector
- A CTF-like agent (Eyach virus) in France, Germany, Netherlands, and former Czech Republic and CTF variants found in California in black-tailed jackrabbits have been associated with human disease.
- Disease surveillance reports from six Western states documented 441 clinical cases between 1985 and 1989. Clinical cases are thought to be greatly underreported.
- There are no good serologic survey data.

**Incubation Period:**

- Mean incubation period is 3-4 days following a tick bite (range: <1-14 days).

**Likelihood of Clinical Disease:**

- Unknown

**Primary Disease Symptoms:**

- Abrupt onset of fever (biphasic course in 50% of cases), chills, headache, retroorbital pain, photophobia, myalgia, malaise
- GI symptoms in ~20% of cases (abdominal pain, nausea, vomiting)
- A maculopapular or petechial rash is seen in 15% of patients.

**Severity of Clinical Disease:**

- Approximately 20% of patients are hospitalized.
- Protracted convalescence for several weeks or months (fatigue, asthenia) is more likely to be seen in adults (70%) than in children.

- Severe CNS and hemorrhagic forms have been described but occur at low frequency (CNS complications reported in 3%-7% of cases).

**Mortality:**

- Rare; three deaths reported in children

**Chronic Carriage:**

- There is no evidence of a persistent carrier state, but prolonged viremia occurs after clinical disease.

**Treatment Available/Efficacious:**

- Ribavirin may be effective.

**Agent-Specific Screening Question(s):**

- No specific question is in use.
- Not indicated because transfusion transmission is limited to a single reported case
- No sensitive or specific question is feasible. In endemic areas, a question on exposure to tick bites has been shown to be ineffective in distinguishing Babesia infected from uninfected donors. This question probably also lacks sensitivity and specificity for this agent.

**Laboratory Test(s) Available:**

- No FDA-licensed blood donor screening test exists.
- Virus isolation from blood or stored refrigerated clots for diagnosis of acute infection
- Direct fluorescent antibody (FA) assay to detect infected cells in clinical samples; indirect fluorescent antibody (IFA) assay to detect patient antibodies using infected cell cultures
- IgM EIA to make presumptive diagnosis with single sample
- IgG EIA to detect four-fold antibody titer rise in acute and convalescent samples
- NAT can be used to detect viral RNA in whole blood.

**Currently Recommended Donor Deferral Period:**

- No FDA Guidance or AABB Standard exists.
- Given the prolonged viremia in some patients, a deferral of 6 months after resolution of symptoms would seem prudent.

**Impact on Blood Availability:**

- Agent-specific screening question(s): Not applicable
- Laboratory test(s) available: Not applicable

**Impact on Blood Safety:**

- Agent-specific screening question(s): Not applicable
- Laboratory test(s): Not applicable

**Leukoreduction Efficacy:**

- This would not be effective given that the replication site of the virus is the RBC.

**Pathogen Reduction Efficacy for Plasma Derivatives:**

- Theoretically, highly susceptible to inactivation because other viruses in the same family (e.g., bluetongue virus) are inactivated by these types of treatment.

**Other Prevention Measures:**

- Tick-avoidance measures (e.g., long pants, long sleeves, repellants)

**Suggested Reading:**

1. Calisher CH. Colorado tick fever: current approaches to diagnosis and treatment. Infect Med 1998;15:524-33.
2. Centers for Disease Control. Transmission of Colorado Tick Fever Virus by blood transfusion—Montana. Morb Mortal Wkly Rep MMWR 1975;24:422-7.
3. Leiby DA, Gill JE. Transfusion-transmitted tick-borne infections: a cornucopia of threats. Trans Med Rev 2004;18:293-306.
4. Roy P. Orbiviruses. In: Knipe DM, Howley PM, editors. Fields virology, 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2007. p. 1978-97.
5. Tsai, TF. Orthoreoviruses and orbiviruses. In: Mandell GL, Bennett JE, Dolin R, editors. Principles and practice of infectious diseases, 5th ed. Philadelphia: Churchill Livingstone; 2000. p. 1693-6.