

***Borrelia* Species**

Disease Agent:

- *Borrelia recurrentis*—Tick-borne relapsing fever
- *B. duttoni*—Louse-borne relapsing fever

Disease Agent Characteristics:

- Not classified as either Gram-positive or Gram-negative, facultatively intracellular bacterium
- Order: Spirochaetales; Family: Spirochaetaceae
- Size: 20-30 × 0.2-0.3 μm
- Nucleic acid: Approximately 1250-1570 kb of DNA

Disease Name:

- Relapsing 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: Very low

Background:

- Relapsing fevers occur throughout the world, with the exception of a few areas in the Southwest Pacific. The distribution and occurrence of endemic tick-borne relapsing fever (TBRF) are governed by the presence of enzootic cycles of the transmitting tick vector. The distribution of epidemic louse-borne relapsing fever (LBRF) is determined by socioeconomic and ecologic factors.
- TBRF
 - Caused by a number of *Borrelia* species throughout the world. Small outbreaks of TBRF are seen in the western US and spread by the bite of an argasid (soft) tick vector (genus *Ornithodoros*).
- LBRF
 - Causes epidemics in crowded conditions, such as refugee camps, or times of large-scale civil disruption and dislocation
 - Spread by the human body louse (*Pediculus humanus*)
 - Restricted mainly to the developing world and not considered a major health threat in the US, although imported cases do occur in travelers
 - Infection occurs by bites or when the vector is crushed by the host. *Borrelia* residing in the hemolymph of the vector enter the host via broken skin at the bite site.

Common Human Exposure Routes:

- Bite of tick or louse vector

Likelihood of Secondary Transmission:

- Secondary transmission of relapsing fever from blood exposure or blood contact with broken skin or conjunctiva, contaminated needles

At-Risk Populations:

- Persons with exposure to the tick vector and people living in crowded conditions with degraded public health infrastructure

Vector and Reservoir Involved:

- Argasid (soft) ticks: Tick-borne (endemic) relapsing fever. Rodents are the reservoir.
- Human body louse: Louse-borne (epidemic) relapsing fever. No nonhuman reservoir

Blood Phase:

- Bacteria are present in high numbers in the blood during febrile episodes and at lower levels between fevers.
- The duration of bacteremia is not well characterized, but recurrent fevers can persist for several weeks to months.

Survival/Persistence in Blood Products:

- No information for *B. recurrentis*; however, laboratory studies indicate that *B. burgdorferi* survives in fresh frozen plasma, RBCs, and platelets for the duration of their storage period.

Transmission by Blood Transfusion:

- Louse- and tick-borne relapsing fevers have been transmitted by laboratory exposure to clinical samples in over 40 cases.
- In the 1930s, six cases of transfusion transmission of relapsing fever borreliosis (unknown types) were reported from China, with documentation of spirochetes in blood of donors and recipients. Transmission by blood has been alleged in Africa.

Cases/Frequency in Population:

- *Borrelia recurrentis* (TBRF) is rare (Western US).
- *B. duttoni* (LBRF) is not found in the US.

Incubation Period:

- *Borrelia recurrentis* (TBRF): approximately 2-18 days
- *B. duttoni* (LBRF): 5-15 days

Likelihood of Clinical Disease:

- Appears to be significant

Primary Disease Symptoms:

- Characterized by recurring high fevers
- Symptoms are absent between fevers.

Severity of Clinical Disease:

- Can be very severe in debilitated persons

Mortality:

- Case fatality rate in untreated individuals is thought to be between 2 and 10%.
- Fatalities may be much higher in famine victims and young children.

Chronic Carriage:

- No information found

Treatment Available/Efficacious:

- Antibiotics (e.g., tetracycline, doxycycline, or penicillin)
- Jarisch–Herxheimer reactions are common with treatment.

Agent-Specific Screening Question(s):

- No specific question is in use.
- Not indicated because transfusion transmission is very infrequent, and incidence of infection in the population is very low.
- 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 *Babesia*-uninfected donors. This question probably also lacks sensitivity and specificity for *Borrelia* species.

Laboratory Test(s) Available:

- No FDA-licensed blood donor screening test exists.
- Current diagnosis reliant on microscopic and culture methods

Currently Recommended Donor Deferral Period:

- No FDA Guidance or AABB Standard exists.
- Prudent practice would be to defer donor until signs and symptoms are gone and a course of treatment is completed.

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) available: Not applicable

Leukoreduction Efficacy:

- Unlikely to be effective

Pathogen Reduction Efficacy for Plasma Derivatives:

- Specific data indicate that the multiple steps in the fractionation process are robust and capable of inactivating and/or removing bacteria at concentrations that may be present in plasma.

Other Prevention Measures:

- Not applicable in developed countries
- Institute de-lousing programs in refugee camps.
- In Third World or refugee environments, blood collection should be avoided in refugee camps, and others, where louse-borne relapsing fever has been endemic.

Suggested Reading:

1. Centers for Disease Control and Prevention. Tick-borne Relapsing Fever Outbreak after a family gathering—New Mexico, August 2002 Morb Mortal Wkly Rep MMWR, 2003;52:809-12.
2. Fihn S, Larson EB. Tick-borne Relapsing Fever in the Pacific Northwest: an underdiagnosed illness? West J Med 1980;133:203-9.
3. Fritz CL, Bronson LR, Smith CR, Schriefer ME, Tucker JR, Schwan TG. Isolation and characterization of *Borrelia hermsii* associated with two foci of Tick-Borne Relapsing Fever in California. J Clin Microbiol 2004; 42:1123-8.
4. Hira PR, Husein SE. Some transfusion induced parasitic infections in Zambia. J Hyg Epidemiol Microbiol Immunol 1979;23:436-44.
5. Schwan TG, Raffel SJ, Schrupf ME, Webster LS, Marques AR, Spano R, Rood M, Burns J, Hu R. Tick-borne relapsing fever and *Borrelia hermsii*, Los Angeles County, California, USA. Emerging Infectious Diseases 2009;15:1026-31.
6. Wang CW, Lee CU. Malaria and relapsing fever following blood transfusion including the report of a case of congenital transmission of relapsing fever. Chin Med J 1936;50:241-8.