

Trypanosoma cruzi

Disease Agent:

- *Trypanosoma cruzi*

Disease Agent Characteristics:

- Protozoan, 16-20 µm (trypomastigotes) 1.5 × 4.0 µm (amastigotes)
- Order: Kinetoplastida
- Family: Trypanosomatidae
- Metacyclic trypomastigotes and amastigote life-cycle stages found in human hosts.
 - Metacyclic trypomastigotes (hemoflagellates) are intermittently found in the peripheral blood and are the stage that transmits the infection to vectors or blood recipients.
 - Amastigotes are intracellular, tissue-dwelling forms, often associated with cardiac tissue.

Disease Name:

- Chagas' disease
- American trypanosomiasis

Priority Level:

- Scientific/Epidemiologic evidence regarding blood safety: Low since the implementation of blood donor screening test
- Public perception and/or regulatory concern regarding blood safety: Moderate; regulatory concern is increasing.
- Public concern regarding disease agent: Low

Background:

- Agent is naturally limited to American continent (North, Central, and South).
- Stable in endemic countries, but with decreased frequency in rural areas because of vector control and improvements in housing. However, large reservoir populations throughout parasite's range ensure that *T. cruzi* will never be completely eradicated.
- Emergent in nonendemic countries (US, Canada, Europe) because of increase in immigration
- Infected vector insects are present in the southern US, and autochthonous transmission is described infrequently. CDC reports that the insect vector is present in 27 states in the US; the northern range extends from Pennsylvania and New Jersey in the east to California and Nevada in the west. In the US, the parasite is restricted to latitudes below 40°.

Common Human Exposure Routes:

- Exposure to feces from infected vector
- Blood transfusion and organ transplantation
- Congenital transmission and breast-feeding

- Oral ingestion of insect-contaminated food or beverages

Likelihood of Secondary Transmission:

- Moderate
- Transmitted congenitally, by blood transfusion and organ transplant
- Five cases of organ-transmitted *T. cruzi* in the US including one cluster of 3 cases from a single donor

At-Risk Populations:

- Residents of, or immigrants from endemic regions particularly from impoverished rural communities with unplastered walls and thatched roofs
- Recipients of untested blood in Latin America
- Children of infected mothers

Vector and Reservoir Involved:

- Triatomine or reduviid bugs, particularly those from the genus *Triatoma*, *Rhodnius*, and *Panstrongylus*; 11 species reported in the US
- Large sylvatic reservoir populations exist in endemic countries. In the US, *T. cruzi* is found in 18 mammal species including opossums, raccoons, and other sylvatic animals.

Blood Phase:

- Parasitemia occurs during symptomatic acute phase lasting from weeks to months.
- Parasitemia is intermittently detectable during asymptomatic indeterminate and chronic phase.

Survival/Persistence in Blood Products:

- Parasites persist and remain in whole blood at 4°C for at least 18 days.
- Survival in RBCs at 4°C is days to weeks but is less well documented than survival in whole blood.
- Survival in platelets under normal storage conditions for up to 5 days
- The viability of the parasite in frozen plasma components is 24 hours or less.
- The viability in frozen RBC components is unknown.

Transmission by Blood Transfusion:

- Seven cases documented in the US and Canada but more are likely to have occurred and been undetected.
- In Latin America, 12-25% of recipients of seropositive units were infected following the transfusion of fresh, whole blood.
- Infection leading to detectable clinical disease is more common in immunocompromised recipients.
- Components with the greatest risk of transmission are whole blood and platelets. In four of the US cases where an implicated donor was identified (based on

history of having resided in a Chagas' endemic area), the component responsible for transmission was a platelet unit. In a fifth case, transmission from a platelet unit was also likely. The transmitting component in the other two North American cases was not identified in the case report.

Cases/Frequency in Population:

- 100 million people at risk in endemic areas and 7.7 million infected in 18 Latin American countries. It is estimated that 1-2 million exhibit chronic features (cardiac or gastrointestinal), with 14,000-45,000 annual deaths.

Incubation Period:

- 20-40 days, usually manifested by fever of unknown origin

Likelihood of Clinical Disease:

- Generally asymptomatic, but 20-30% of infected individuals develop clinically relevant complications

Primary Disease Symptoms:

- Fever, hepatosplenomegaly, and cardiac symptoms

Severity of Clinical Disease:

- Severe, particularly in immunocompromised recipients, where some lethal cases are described in the acute phase

Mortality:

- In Latin America, 14,000-45,000 deaths annually
- Mortality high in acute transfusion-transmitted infection when recipients are immunocompromised. True mortality rate from transfusion transmission is unknown.

Chronic Carriage:

- Lifetime

Treatment Available/Efficacious:

- Benznidazole or nifurtimox are used for therapy, but effectiveness varies and greatest success is in treating acute stages. In the US, nifurtimox can be obtained through CDC.

Agent-Specific Screening Question(s):

- Currently in use as part of Donor History Questionnaire: "Have you ever had Chagas' disease?"
- Potential risk-factor questions (e.g., birth/residence in an endemic country) have been shown to have a low positive predictive value so have not been recommended.

Laboratory Test(s) Available:

- In the US, one EIA for blood donor screening has been licensed but not required by FDA. Some, but not all blood organizations, are using the test to screen donations.
 - After 2 years of mainly universal screening in the US, testing strategies will likely be modified to a selective strategy based upon at least one-time testing of every donor.
- In Latin America, there are more than 100 tests approved for blood screening.
- IHA, IFA, EIA, western blot, RIPA, chemiluminescence, and NAT methods are available, but a true gold standard remains controversial. Direct parasite detection can be made by smear, xenodiagnosis, and culture; PCR has also been used as direct evidence of the presence of parasites.

Currently Recommended Donor Deferral Period:

- History of Chagas' disease is a lifetime/permanent deferral.

Impact on Blood Availability:

- Agent-specific screening question(s): Current question has no impact.
- Laboratory test(s) available: Low because of the low prevalence of *T. cruzi* antibody in the US blood donor population and the high specificity of the FDA-licensed EIA

Impact on Blood Safety:

- Agent-specific screening question(s): Current question has no impact.
- Laboratory test(s) available: Will significantly decrease the transmission of *T. cruzi*

Leukoreduction Efficacy:

- Low; though parasites are partially retained by leukocyte filters, there is no evidence to support protection of blood recipients when receiving leukoreduced units. At least one transfusion-transmitted case has been documented from a leukoreduced platelet concentrate.

Pathogen Reduction Efficacy for Plasma Derivatives:

- No specific data are available, but it is presumed that the agent would be sensitive to many measures used in the fractionation process.
- Freezing plasma kills the parasite.

Other Prevention Measures:

- First agent for which chemical treatment of whole blood was shown to be effective (crystal violet). More recently, platelet inactivation by amotosalen

and UV light (INTERCEPT) or riboflavin and ultraviolet light (Mirasol PRT System), and for plasma either INTERCEPT or methylene blue have been shown to be effective.

Suggested Readings:

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