Am. J. Trop. Med. Hyg., 99(6), 2018, pp. 1534–1536
doi:10.4269/ajtmh.18-0485

Evidence of Likely Autochthonous Transmission of Chagas Disease in Arizona

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Abstract. A healthy 16-year-old girl born and raised in Tucson, AZ, had screening and confirmatory testing revealing Chagas disease; clinical evaluation established that she had the indeterminate form of chronic Chagas disease with evidence of likely autochthonous transmission. *Trypanosoma cruzi* DNA was detected by conventional polymerase chain reaction in *Triatoma rubida* captured at her home.

CASE REPORT

A 16-year-old girl was referred to the pediatric infectious diseases outpatient clinic after attempting to donate blood. On routine blood donor screening, her blood was reactive by *Trypanosoma cruzi* qualitative chemiluminescent immunoassay and enzyme strip immunoassay (ESA) Chagas test. These results were reported to the Arizona Department of Health Services (AZDHSs). Confirmatory diagnostic testing was performed at the Centers for Disease Control and Prevention (CDC) in Atlanta, GA. *Trypanosoma cruzi* antibody enzyme immunoassay (EIA) was reactive and trypomastigote excreted and secreted antigen immunoassay was positive (Table 1).

Clinical evaluation and course. The patient was seen within 2 months of her attempt to donate blood. She was in normal health and had no physical complaints. Complete review of systems was unremarkable. She was afebrile with a blood pressure of 142/69 mm of Hg and an unremarkable physical examination of the heart and abdomen. A complete blood count and comprehensive metabolic panel were within normal limits. A 12-lead electrocardiogram demonstrated a normal sinus rhythm at 62 beats per minute with a borderline-prolonged PR interval of 196 ms (normal < 200 ms). A 2-D transthoracic echocardiogram demonstrated a structurally normal heart with normal physiologic parameters for her age group. No dysrhythmias were noted after continuous cardiac rhythm monitoring for 14 days. Magnetic resonance imaging of the heart with flow mapping was unremarkable and without evidence of myocardial fibrosis or ventricular dysfunction. Based on the two separate highly specific diagnostic tests performed at CDC in the absence of signs or symptoms of disease, she was considered to have the indeterminate form of chronic Chagas disease.[1] After discussion with the patient, her guardian, and the Parasitic Diseases Branch at CDC, the patient received oral benznidazole at 5.3 mg/kg/day divided into two daily doses for 60 days. A pregnancy test was negative and serial complete blood counts and renal and liver function tests were normal. She tolerated the drug without any adverse reactions.

Assessment of patient's possible environmental exposure to *T. cruzi.* After screening tests were reported positive, AZDHS and local public health officials interviewed the patient and guardian for travel, food-borne, and vector-borne exposures. The patient resided with her parents and siblings in a single-family home located in the foothills of the Santa Catalina Mountains in Tucson, AZ. The home is less than 20 years old. She was born in Tucson and lived there her entire life. Her only travel outside the United States was to Europe (France, Germany, Spain). At the age of 13 years, she stayed 4 days in a modern condominium in Puerto Peñasco located in the northern state of Sonora, Mexico, approximately 120 miles south of Tucson. She did not camp out or participate in any outdoor activities aside from going to the beach. The patient did not recall consuming any raw fruit drinks while outside the United States. She had no history of receiving blood transfusions or an organ transplant. The patient's mother and siblings were negative for *T. cruzi* antibody by EIA tests. The family reported using outdoor lighting at night and an active pack rat (*Neotoma albigula*) infestation on their property with multiple attempts at extermination without success. This rodent is the most common blood meal source for *Triatoma rubida* in the southwest United States.[2] The family had two dogs confined indoors, but no other pets. Nighttime trapping with black lighting on three collection days during June and July 2017 resulted in the collection of three adult *T. rubida* from around the patient's home, one specimen per night. The family also provided a collection of insects captured inside the home, one of which was a *T. rubida* nymph. *Trypanosoma cruzi* DNA was detected in all three adult *T. rubida*, but not in the nymph by conventional PCR using *T. cruzi*–specific primers TCZ1 and TCZ2.[3] DNA was extracted from the terminal 1/3 of the abdomen using a separate sterile razorblade, Petri dish, and tweezers. The positive control was DNA-purified from cultured *T. cruzi* (gift of P. L. Dorn). Negative controls included no DNA and, second, laboratory-grown *T. rubida* without parasites (gift of J. O. Schmidt). This study was approved by the University of Arizona Institutional Review Board (IRB).

DISCUSSION

We describe evidence of likely autochthonous transmission of Chagas disease in Arizona in a 16-year-old girl. She was found to have positive serologies to *T. cruzi* on routine screening of her blood donation. Chagas disease is a reportable

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TABLE 1
Patient blood donor screening and confirmatory diagnostic testing for Chagas disease

Laboratory	*Trypanosoma cruzi* serological testing	Results
American Red Cross	PRISM® Chemiluminescent immunoassay (Abbott Laboratories, Abbott Park, IL)	Reactive
American Red Cross	ESA Chagas test (Abbott Laboratories, Abbott Park, IL)	Reactive
CDC	*T. cruzi* Ab EIA	Reactive (OD = 0.513)*
CDC	*T. cruzi* Ab IB (trypomastigote excreted-secreted antigen-immunoblot)	Positive

Ab = antibody; CDC = Centers for Disease Control and Prevention; EIA = enzyme immunoassay; ESA = enzyme strip immunoassay; OD = optical density.
* Reactive: OD > 0.330, nonreactive: OD < 0.270, indeterminate: OD 0.270–0.

communicable disease in the state of Arizona which prompted the AZDHS and local public health officials to conduct an investigation into the patient's travel, food-borne, and vector-borne exposures. Confirmatory immunoglobulin G serologic testing, preferably with two different test formats using different antigen preparations, is needed to confirm a diagnosis of chronic Chagas disease.[1] In the United States, the CDC's Division of Parasitic Diseases and Malaria offers this confirmatory testing at their reference laboratory. Our patient was in a normal state of health with no evidence of cardiac and/or gastrointestinal disease but with positive serologies (Table 1). Therefore, she has an indeterminate stage of chronic Chagas disease. Among persons chronically infected with *T. cruzi*, 20–30% are estimated to progress to Chagas cardiomyopathy,[1] and antitrypanosomal therapy is recommended to reduce the risk of progression to clinical disease, especially in children and adolescents.[1,4] Our patient was treated with benznidazole without serious adverse effects. In general, benznidazole is well tolerated in children and young adults. Benznidazole is now approved by the U.S. Food and Drug Administration, but not yet commercially available. Our patient obtained the drug through the expanded access for treatment of Chagas disease program at CDC (CDC IRB Protocol #5765).

The patient's exposure to triatomines in Tucson was the likely source of her infection. The patient lived in an area of Tucson where triatomines commonly feed on pack rats, which are a wildlife host reservoir for *T. cruzi*. The patient reported seeing kissing bugs and their hosts (pack rats), around her home. Three adult *T. rubida* captured in the peridomiciliary area of her home were positive for *T. cruzi* by PCR. Also, environmental factors such as routinely using outside nighttime lighting and the presence of pets in the home may have increased her chances of contact with triatomines.[2] Kissing bug domiciliation or infestation of human dwellings has been described in this region of southern Arizona.[5,6] Furthermore, *T. rubida* in Tucson often harbor *T. cruzi*: 128 *T. rubida* captured in a zoological park had a rate of carriage of *T. cruzi* of 25%.[7] An earlier study by Reisenman et al.[8] demonstrated a rate of carriage of *T. cruzi* by *T. rubida* to be 41% (N = 158 bugs). Interestingly, *T. rubida* and *Triatoma protracta* captured in Arizona and California demonstrated that 38% of the bugs had a human blood meal in the abdomen.[9] We considered the possibility that infection was acquired during her travel to Puerto Peñasco, Mexico, on a short trip. One study conducted in Sonora, Mexico, showed seropositivity in domestic dogs for exposure to *T. cruzi*,[10] but no human cases to our knowledge have been described in Puerto Peñasco, Mexico. Regardless, it is unlikely that transmission took place at that time because of the short duration of the visit, her stay in a modern resort complex at a beachside condominium, and her denial of ingesting raw fruits or seeing triatomines during that trip.

Triatominae can be found worldwide and are classified into five tribes and 15 genera, including 147 described species most of which are exclusively found in the New World. *Trypanosoma cruzi* vector-borne transmission only occurs in the Americas because the parasite is harbored by the triatomines that inhabit the New World.[11] In our patient, her travel to Europe is not considered an exposure risk because *T. cruzi* vector-borne transmission is not found in that part of the world. Reports of presumed autochthonous transmission of *T. cruzi* in the United States are increasing because of blood donation screening. Infected blood donors often present with chronic indeterminate Chagas like our patient.[12] Autochthonous *T. cruzi* infections have been reported in multiple states including California, Louisiana, Texas, Tennessee,[13] and, perhaps now, Arizona. One other case of autochthonous Chagas disease may have arisen in Arizona, but the patient was also potentially exposed to *T. cruzi* on a military base in south Texas,[14] an area endemic for canine Chagas disease.[15]

The risk of autochthonous transmission of *T. cruzi* infection in the United States is undefined and likely low, but reporting probable autochthonous cases such as this will be important for identifying the risk factors for acquiring Chagas disease in the United States.

Received June 8, 2018. Accepted for publication August 14, 2018.

Published online October 1, 2018.

Acknowledgments: We would like to thank the patient and family for helping us with this thorough investigation. We also would like to thank Susan Montgomery from the U.S. Centers for Disease Control and Prevention, Parasitic Diseases Branch, for her professional review and annotation of the manuscript. We want to acknowledge the help of Nicole Bradley-Behrens and Maria Love from the University of Arizona College of Medicine, Department of Immunobiology, for their technical assistance with the detection of *T. cruzi*.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the view of the Department of Health and Human Services or the Centers for Disease Control and Prevention.

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