Chagas disease in your backyard?

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Chagas disease basics

- Protozoan parasite *Trypanosoma cruzi* only found in the Americas
- Vector-borne zoonosis, many animal reservoirs
- Transmission
  - Triatomine bugs – most common
  - Congenital
  - Contaminated blood components, organ or tissue
  - Laboratory accidents
  - Foodborne
- Estimated 8 – 11 million people have Chagas disease in Latin America
Trypanosoma cruzi

Triatomine Bug Stages
1. Triatomine bug takes a blood meal (passes metacyclic trypomastigotes in feces, trypomastigotes enter bite wound or mucosal membranes, such as the conjunctiva)
2. Metacyclic trypomastigotes penetrate various cells at bite wound site. Inside cells they transform into amastigotes.
3. Amastigotes multiply by binary fission in cells of infected tissues.
4. Intracellular amastigotes transform into trypomastigotes, then burst out of the cell and enter the bloodstream.
5. Triatomine bug takes a blood meal (trypomastigotes ingested)
6. Epimastigotes in midgut
7. Multiply in midgut
8. Metacyclic trypomastigotes in hindgut

Human Stages

\[\Delta = \text{Infective Stage} \]
\[\delta = \text{Diagnostic Stage} \]
Chagas disease transmission

Trypanosoma cruzi

Mammalian hosts

Triatomine vectors
Acute phase of Chagas disease

T. cruzi infection ~8 weeks

Chronic phase

Indeterminate form
No signs or symptoms of Chagas disease

20 - 40% progress over years - decades

60 - 80% remain indeterminate throughout life

Can reactivate if immunosuppressed

Determinate forms
• Chagas cardiomyopathy &/or
• Gastrointestinal disease

Life long infection if untreated
Clinical diagnosis of Chagas disease

- **Acute infection**
  - Identifying the parasite in blood smear or buffy coat
  - Blood cultures
  - PCR can have limited sensitivity

- **Chronic infection**
  - Persistent circulating antibody
  - Problems with specificity and sensitivity
  - No gold standard test for Chagas disease
Anti-parasitic treatment

- Nifurtimox and benznidazole
- Most effective during early infection
- Difficult to tolerate
- Not FDA approved, only available from CDC under investigational new drug (IND) protocols
Chagas disease worldwide

- Programs in Latin America focus on controlling transmission
  - Vector control
  - Blood safety
- WHO Global Network for Chagas disease, 2007
  - Endemic and non-endemic countries
  - Unique situation in the U.S.
- Renewed attention to control
  - World Health Assembly resolution in 2010
  - PAHO resolution in 2010
- Drug donation (nifurtimox) to WHO
Estimated current prevalence in endemic countries

- **> 3%**
  - Bolivia
  - Argentina

- **1 - 3%**
  - Paraguay
  - Guatemala
  - Ecuador
  - Guayana
  - El Salvador
  - Honduras

- **< 1%**
  - Chile
  - Belize
  - Peru
  - Venezuela
  - Nicaragua
  - Mexico
  - Brazil
  - Uruguay
  - Costa Rica
  - Panama

Endemic for human Chagas disease
Infected vectors, nonhuman mammals
History of triatomines and *T. cruzi* in the United States

- 1855 – Vector bugs identified in Georgia
- 1860’s / 70’s – Vector bugs identified in six more states
- **1909** – Discovery of parasite and disease (Brazil)
- 1916 – Parasite first observed in California
- 1930’s – Reservoir host infections studied in U.S.
- 1955 – First autochthonous cases of Chagas disease reported
Who is at risk in the U.S.

- **People who acquired the infection in endemic countries of Latin America**
  - Estimated > 300,000 infected immigrants in U.S.*
  - Travelers to endemic areas

- **People who acquire the infection in the United States**
  - Children of infected mothers
  - Laboratory staff working with vectors, reservoir species, or parasite
  - Transplant recipients
  - Transfusion recipients
  - Exposed to infected vectors / reservoirs

*Bern and Montgomery, Clin Infect Dis 2009
Congenital and laboratory transmission cases

- Estimated between 63 – 315 babies born with Chagas disease every year*

- Confirmed congenital transmission case in 2010
  - Mother originally from Bolivia
  - Baby born with evidence of disease

- Transmission associated with laboratory accident
  - 8 cases reported in United States
  - 3 needlestick injuries
  - 3 contact with infectious materials / break in skin
  - 2 unknown route of infection

* Bern and Montgomery, Clin Infect Dis 2009
Transplant transmission in the U.S.

- **Five published cases**
  - 2001 cluster of 3 cases from same donor
  - 2006 heart transplant—other transplanted organ recipients negative
  - 2006 heart transplant—other transplanted organ recipients negative

- **Recent transmission to heart transplant recipient (unpublished)**
  - Successfully treated
  - Other organ recipients negative

- **Other suspected cases investigated but no documented transmission**
Transfusion transmission in the U.S. and Canada

- 7 transfusion transmission cases reported, U.S. and Canada
- Two more transfusion transmission cases reported at 2010 AABB meeting, both platelet recipients from same donor (Argentina)

<table>
<thead>
<tr>
<th>Year</th>
<th>Recipient residence</th>
<th>Country of donor</th>
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<tbody>
<tr>
<td>1987</td>
<td>California</td>
<td>Mexico</td>
</tr>
<tr>
<td>1989</td>
<td>New York City</td>
<td>Bolivia</td>
</tr>
<tr>
<td>1989</td>
<td>Manitoba</td>
<td>Paraguay</td>
</tr>
<tr>
<td>1993</td>
<td>Houston</td>
<td>unknown</td>
</tr>
<tr>
<td>1999</td>
<td>Miami</td>
<td>Chile</td>
</tr>
<tr>
<td>2000</td>
<td>Manitoba</td>
<td>Paraguay</td>
</tr>
<tr>
<td>2002</td>
<td>Rhode Island</td>
<td>Bolivia</td>
</tr>
</tbody>
</table>
States with documented potential *T. cruzi* vectors

~ 11 potential vector species in US
States with documented mammalian reservoirs

- Vectors only
- Reservoir and vectors
- >18 reservoir species in US
Autochthonous transmission in the U.S.

- Sylvatic cycle below 40th parallel
- Seven autochthonous human cases published
- At least 15 additional cases among blood donors*

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>Texas</td>
<td>infant</td>
</tr>
<tr>
<td>1955</td>
<td>Texas</td>
<td>infant</td>
</tr>
<tr>
<td>1982</td>
<td>California</td>
<td>56 year old woman</td>
</tr>
<tr>
<td>1983</td>
<td>Texas</td>
<td>infant</td>
</tr>
<tr>
<td>1998</td>
<td>Tennessee</td>
<td>infant</td>
</tr>
<tr>
<td>2006</td>
<td>Louisiana</td>
<td>74 year old woman</td>
</tr>
<tr>
<td>2006</td>
<td>Texas</td>
<td>infant</td>
</tr>
</tbody>
</table>

* Reported at 2010 AABB annual conference,
States with possible vector-borne transmission

- **Vectors only**
- **Reservoir and Vectors**
- **Vector-borne transmission**

Map showing states with possible vector-borne transmission.
Have you seen *Triatoma sanguisuga*?

**Triatoma sanguisuga**

**Key characteristics:**

1. Orange-red to yellowish horizontal markings covering ≥ ¼ of abdominal segment
2. Mouthparts relatively hairless
3. Pronotum black with orange-red to yellowish side and top margins
4. Tip of scutellum long, narrow
5. Distinctive orange-red to yellowish markings on wings

Special thanks to Dr. Sonia Kjos
Dogs in the U.S. and Chagas disease

- Dogs with Chagas disease reported in Texas and Louisiana, other southern states
- Route of infection most likely oral—eating infected bugs
  - Hunting dogs, dogs housed outdoors
- Canine acute and chronic *T. cruzi* infection
  - Acute disease more frequently severe, possibly due to dose and route of infection
  - Not all chronically infected develop clinical disease
  - Cardiac arrhythmias, myocarditis, heart failure
- Treatment approaches extrapolated from human studies but drugs are not approved in the U.S.
Public health challenges

- **Health care system**
  - Physician awareness and education
  - Awareness in populations at risk

- **Public health system**
  - Not nationally notifiable, reportable in AZ, MA, and TN
  - Low testing capacity at local / state public health laboratories

- **Defining the U.S. burden of disease and risk**
  - Cardiac disease morbidity and mortality
  - Gastrointestinal disease burden
  - Congenital transmission
  - Autochthonous infections and their outcomes

- **Emerging concern for transplant transmission risk and prevention**
Public health interventions for Chagas disease in the United States

- **Physician awareness**
  - KAP surveys among physicians, including OB/GYN, transplant medicine, infectious disease
  - Chagas disease CME online

- **Ensuring treatment drug availability**
  - FDA approval to maintain drug stocks at CDC
  - Release of treatment drug for individual patients under IND protocols

- **Preventing transfusion transmission by blood donor screening**

- **Preventing transplant transmission**
CDC nifurtimox releases by year
1997 – 2010*

* as of November 10, 2010
December 2006: FDA approves first blood donation screening assay for antibody to *T. cruzi*

- **Testing started in early 2007**
- **No final guidance from FDA**
  - Blood centers not required to screen for Chagas disease
  - Industry organization (AABB) developed voluntary guidelines for screening
- **Donors deferred based on reactive test in duplicate (some centers also confirming with RIPA)**
- **~14 million donations screened in first 16 months**
  - Approximately 28% confirming by RIPA
  - ~1:27,500 donors RIPA positive
  - ~1:3,800 South Florida
  - ~1:8,300 Southern California (previously deferred donors not included)
Recent changes to blood donor screening

- Currently ~90% of the blood supply is screened
- BUT many blood centers now screening donors once
  - If positive, deferred indefinitely; if negative future donations not tested
  - Cost concerns
  - Few / no reports of transfusion transmitted Chagas disease
  - What are they missing with this approach?
    - New infections?
    - Donors who test close to assay cutoff level?
- FDA approves second assay in April 2010 (different manufacturer)
Confirmed positive blood donors
2007 – 2010*, n = 1,314

*Source: AABB Biovigilance program, as of November 24, 2010
Strategies to prevent and control transplant-associated transmission

- No regulation regarding screening for *T. cruzi* infection in organ donors

- Education regarding risk of transmission by organ type

- Some organ procurement organizations (OPOs) screen donors for *T. cruzi* infection
  - Only certain tests suitable for this purpose
  - Additional OPOs considering targeted screening

- Monitoring recipients post-transplant
  - Parasitological testing (buffy coat preps, PCR) during first few months and/or when rejection event or illness occurs
  - Prompt treatment associated with better outcomes
CDC Chagas disease resources

- **CME Chagas disease: What U.S. physicians need to know**

- **CDC Chagas disease website**
  - [http://www.cdc.gov/parasites/chagas](http://www.cdc.gov/parasites/chagas)
  - One page information sheets for physicians and the public
  - Frequently asked questions regarding blood donation screening
  - Expanded information on vectors in the U.S.

- **Parasitic Diseases Inquiries** (770) 488-7775, chagas@cdc.gov
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Thank you!

For more information please contact Centers for Disease Control and Prevention

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