

Trypanosoma cruzi

Objectives

- Introduction
- Biology: morphology, host, habitat, mode of transmission, life cycle.
- Clinical presentation
- Diagnosis
- Treatment
- Prevention and control

Introduction:

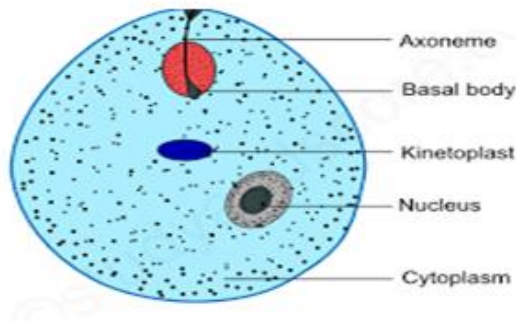
- It causes **Chagas disease**,
- Zoonotic disease
- Transmitted to humans by blood-sucking ***Triatomine reduviid* bugs**.

Biology:

Morphology

Amastigote stage:

- They are oval bodies measuring 2-4 μm in diameter having a nucleus and kinetoplast.
- Flagellum is absent.
- Morphologically, it resembles the amastigote of *Leishmania* sp.
- Multiplication of the parasite occurs in this stage.

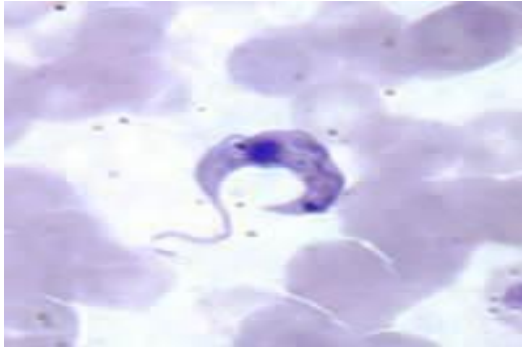


Structure of amastigote (1)

Trypomastigote stage:

- Trypomastigotes are **non** multiplying forms and are taken up by the insect vectors.
- They appear as long, thin flagellates about 15-20 μm long.
- In stained blood smears, they are shaped like alphabet "**C**"; "**U**"; or rarely "**S**";
- **They** have an undulating membrane, and a flagellum running along the undulating membrane, leaving the body at the anterior end.
- A typical trypomastigote has a large, subterminal or terminal kinetoplast
- Centrally located nucleus

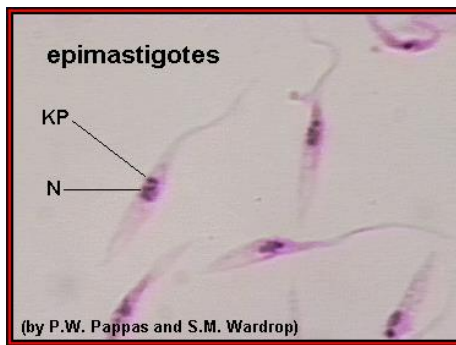
- Motile circulating trypomastigotes are readily seen on slides of fresh anticoagulated blood in acute infection but **are rarely detectable in chronic infection**.
- Trypomastigotes may be seen in cerebrospinal fluid (CSF) in central nervous system infections.



T. Cruzi Trypomastigote (2)

Epimastigote stage:

- Epimastigote forms are the culture form of *T. cruzi*.
- It has a kinetoplast adjacent to the nucleus.
- An undulating membrane runs along the anterior half of the parasite.
- Epimastigotes divide by binary fission in midgut of the vector.



Epimastigot of *T.cruzi* (3)

Note:

- ***Kineloplast consists of***
A deeply staining parabasal body
+
Adjacent dot Like blepharoplast.

Host:

1. Definitive host: Man.
- 2 . Intermediate host (vector): *Reduviid bug (triatomine bugs)*:
 - *Triatoma infestans*
 - *Rhodnius prolixus*
 - *Panstrongylus megistus*.

They are large (up to 3 cm long) night-biting bugs, which typically **defecate while feeding**. The feces of infected bugs contain the metacyclic trypomastigote.

3. Reservoir host: Armadillo, cats, dogs and pigs.

Infective form:

Metacyclic trypomastigotes forms are the infective forms found in feces of reduviid bugs.

Habitat

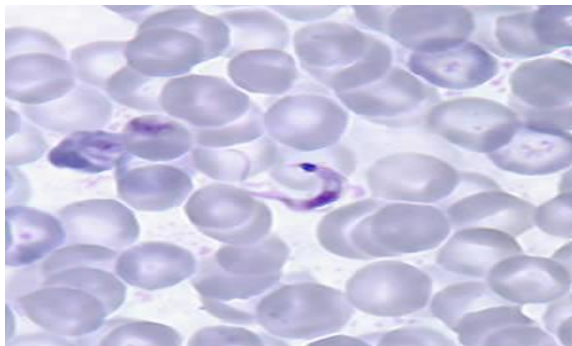
- ❑ In humans, *T. cruzi* exists in both amastigote and trypomastigote forms:
 - Amastigotes are the intracellular parasites. They are found in muscular tissue, nervous tissue and reticuloendothelial system
 - Trypomastigotes are found in the peripheral blood.
- ❑ In reduviid bugs, epimastigote forms are found in the midgut and metacyclic trypomastigote forms are present in hindgut and feces.

Mode of transmission:

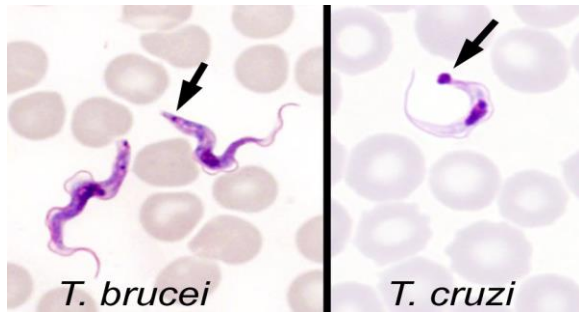
- Transmission of infection to man and other reservoir hosts takes place when mucus membranes, conjunctiva, or wound on the surface of the skin is contaminated by feces of the bug containing metacyclic trypomastigotes(posterior station transmission).
- *T. cruzi* can also be transmitted by:
 - Blood transfusion
 - Organ transplantation
 - Congenital transmission
 - Very rarely by ingestion of contaminated food or drink with presence of mouth ulcers.



Triatomine insect vector ("kissing" bug) (4)



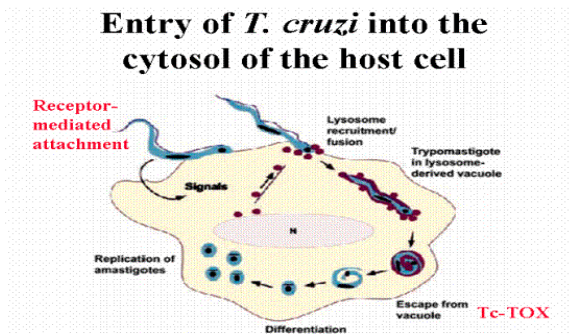
Three *T. cruzi* trypomastigotes in a thin blood smear stained with Giemsa (5).



T.brucei vs T.cruzi trypomastigotes (6)

Life cycle:

- An infected Triatomine insect vector (“kissing” bug) takes a blood meal and releases **metacyclic Trypomastigotes** in its feces near the site of the bite wound (Posterior station transmission).
- Trypomastigotes enter the host through the wound or through mucosal membranes, such as the conjunctiva.
- Inside the host, the *trypomastigotes* invade cells near the site of inoculation, where they differentiate into intracellular **amastigotes**.
- The amastigotes multiply by binary fission
- The amastigotes are released into blood circulation as **trypomastigotes**.
- Trypomastigotes infect cells from a variety of tissues and transform into intracellular amastigotes in new infection sites. Clinical manifestations result from this infective cycle.



Invasion by *T. cruzi* to the cytosol (7)

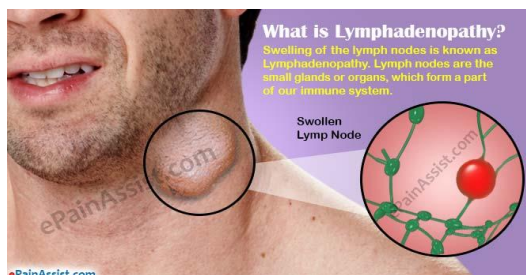
- The bloodstream trypomastigotes do not replicate (different from the African trypanosomes).
- Replication resumes only when the parasites enter another cell or are ingested by another vector.

- The “kissing” bug becomes infected by feeding on human or animal blood that contains circulating parasites.
- The ingested trypomastigotes transform into **epimastigotes** in the vector’s midgut .
- The parasites multiply and differentiate in the midgut .
- They differentiate into infective **metacyclic trypomastigotes** in the hindgut.

Clinical Presentation:

Acute phase:

- The acute phase is usually asymptomatic, but can present with manifestations that include fever, anorexia, lymphadenopathy, hepatosplenomegaly, and myocarditis.



Hepatosplenomegally and cervical lymphadenopathy (9)

- Romãña’s sign (unilateral palpebral and periocular swelling) may appear as a result of conjunctival contamination with the vector’s feces.



Romãña’s sign (10)



A nodular lesion or furuncle, usually called chagoma, can appear at the site of inoculation.

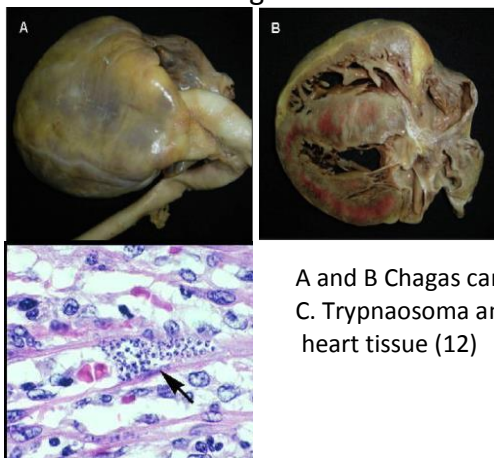
Most acute cases resolve over a period of a few weeks or months into an asymptomatic chronic form of the disease.



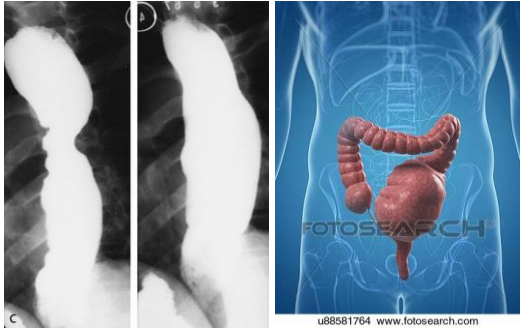
Romana sign and chagoma (11)

Chronic phase

- The symptomatic chronic phase may not occur for years or even decades after initial infection.
- Chronic Chagas disease and its complications can be fatal.
- Its clinical picture includes:
- Cardiomyopathy (the most serious manifestation): It is caused by auto immune reaction: T-cells recognize myosin proteins in the heart. This recognition occurs because *T. cruzi* antigen B13 and heart myosin proteins are molecularly homologous.



A and B Chagas cardiomyopathy
C. Trypanosoma amastigotes nests in heart tissue (12)



Mega esophagus(10)

Mega colon (10)

- Pathologies of the digestive tract such as megaesophagus and megacolon; due to an inflammatory invasion and degeneration of the nervous plexuses.

Congenital infection:

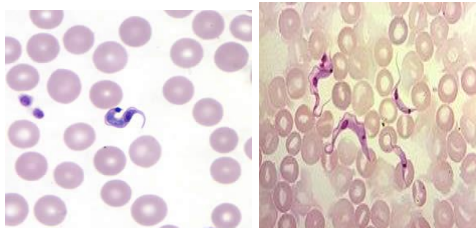
- ***Congenital transmission is possible*** in both acute and chronic phase of the disease causing myocardial and neurological damage in the fetus.

Diagnosis:

Laboratory Diagnosis

A. Microscopy:

- The diagnosis of **acute** disease requires detection of parasites.
- Microscopic examination of fresh anticoagulated blood or the buffy coat is the simplest way to see motile organisms.
- In wet mount, trypomastigotes are faintly visible but their snake-like motion against red blood cells (RBCs) makes their presence apparent.
- Trypomastigotes can also be seen in thick and thin peripheral blood smear, stained with Giemsa stain.



Blood film for Trypanosoma cruzi (2,8)

Note: Serologic testing has no role in diagnosing acute Chagas disease

B. Culture: Novy, McNeal and Nicolle(**NNN**) medium or its modifications are used for growing *T. cruzi*. This medium is inoculated with blood and other specimens and incubated at 22-24°C.

- The fluid taken from the culture is examined microscopically by 4th day and then every week for 6 weeks. Epimastigotes are found in the culture.
- Cell culture (amastigotes and trypomastigotes seen)
- Culture is more sensitive than smear microscopy.
- ***C. Animal inoculation AND Xenodiagnosis (insect inoculation)***

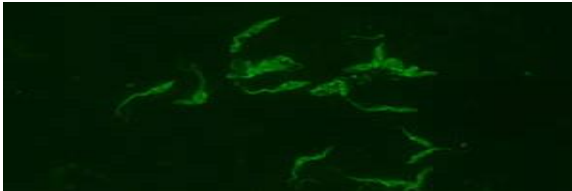
- **D. Histopathology:** Biopsy examination of lymph nodes and skeletal muscles and aspirate from chagoma may reveal amastigotes of *T. cruzi*.

E. Serology:

Antigen detection: *T. cruzi* antigen can be detected in urine and sera in patients with chronic Chagas disease.

Antibody detection: Antibodies (IgG) against *T. cruzi* may be detected by the following tests:

- *Direct agglutination test (DAT)*
- Indirect hemagglutination(IHA)
- ELISA
- Indirect immunofluorescence (IIF)
- Radioimmune precipitation assay (RIPA)
- The disadvantage of the antibody based tests is that they may be false positive with other disease like leishmaniasis and syphilis.
- **Intradermal test:** The antigen "**cruzin**" is prepared from *T. cruzi* culture and used for the intradermal test. A delayed hypersensitivity reaction is seen.
- **F. Molecular diagnosis:** PCR is available that detects specific primers.
- **Other tests:**
- ECG, X-ray :Cardiomyopathy is seen in chronic Chagas disease.
- **Endoscopy** helps in visualization of megaesophagus in Chagas disease.



Positive IFA result with *T. cruzi* antigen (magnification 400x) (14).

Treatment:

- No effective specific treatment is available for treating Chagas disease.
- Nifurtimox and benznidazole have been used with some success in both acute and chronic Chagas diseases.
- These drugs kill only the extracellular trypanosomes but not the intracellular forms.

Prevention and control:

There is no vaccine to prevent Chagas disease.

However, the following prevention and control tools are useful:

- Spraying of insecticides
- Home maintenance to prevent vector infestation.
- Good hygiene practices in food preparation, transportation, storage and consumption.
- Personal preventive measures such as:
 - Bed nets
 - Screening of blood, organ, tissue and cell donors and receivers.

- ✚ Observance of the standard safety protocols (wearing laboratory coats, gloves, face masks, caps and glasses) for laboratory accidents prevention.
- ✚ Screening of infected pregnant women to prevent congenital transmission control.

Summary:

- T cruzi is a kinetoplastid
- Transmitted by blood-sucking *Triatomine reduviid* bugs.
- Has amastigote, epimastigote and trypomastigote forms
- Causes Chagas disease
- Easiest method of diagnosis is microscopy
- Treatment not affect intracellular stages
- No vaccine against parasite and people should take measures to protect themselves against bite of the insect.

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