

# EPIDEMIOLOGIC STUDY OF CHAGAS' DISEASE IN A TOWN IN OAXACA, MEXICO<sup>1</sup>

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## I N T R O D U C T I O N

Since 1940, when Mazzotti first reported human cases of Chagas' disease in Mexico (observed at the town of Tejomulco in Oaxaca State—1), over 150 parasitologically confirmed acute and chronic cases have been reported, most of them in Mexico's Pacific zone (2).

During this period there have been seven epidemiologic investigations of Chagas' disease in Mexico: the first by Biagi and colleagues in 1958 at Tlaxiaco, Mexico State (3); the second by Biagi and Tay in 1964 at Tetitlán, Guerrero State; the third by Tay and colleagues in 1966 in Michoacán State (4); the fourth by Zavala and colleagues (5); the fifth by Ortega and colleagues in 1976 in Chiapas State (6); the sixth by Tay, Salazar, and colleagues in Jalisco State (7); and the seventh the investigation in Oaxaca State that is being reported here.

Prior to this study, 11 clinical cases of Chagas' disease had been reported in the state of Oaxaca. These 11 cases included two of only three chronic cases parasitologically confirmed in Mexico, the first being detected in 1965 by Biagi and Arce in Turutepec (8), and the other being discovered in 1975 by Salazar and colleagues at San Juan Colorado (9).

In addition, chagasic infections of Oaxaca residents have been detected serologically. Biagi and Arce detected two cases this way in 1965 (8); Goldsmith and colleagues reported 47 cases in 1971 (10); and Marcuschamer and Reyes studied one case in 1978 (11).

Finally, there have been reports in Oaxaca of a fair number of other cases with a history of the disease and myocarditis confirmed by autopsy, but without serologic or parasitologic confirmation. Six such cases were described by Tay and colleagues in 1961 (12).

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# MATERIALS AND METHODS

The study reported here was done at the town of Miahuatlán de Porfirio Díaz, municipal seat of Miahuatlán in Oaxaca State. The municipality is situated in the valleys of Oaxaca State, being separated from the Pacific Coast to the south only by the neighboring municipality of Pochutla. The town of Miahuatlán, located 123 km from the state capital (the city of Oaxaca), is directly south of that city and about halfway between Oaxaca and the Pacific; it has a warm climate with a cool winter and a mean annual temperature of 18°C. The vegetation in most of the area is of the desert type, with predominantly xerophilous and herbaceous low-growing plants, although tropical forest is present in the southern part.

The study dealt with 85 patients from the population served by the rural hospital of the town of Miahuatlán. These patients, all of whom were seen at the hospital, were selected because they had epidemiologic or clinical histories suggesting Chagas' disease. Fourteen of these patients had clinical pictures suggestive of the acute phase of the disease (Romaña's sign, a febrile syndrome under observation, myocarditis, or other symptoms). From each of these patients we obtained a complete clinical history, blood specimens (for smears, thick films, growth in NNN culture medium, and serodiagnosis), and an electrocardiogram; each subject was also given chest telerradiography or a heart X-ray series, as appropriate.

The other 71 patients, examined for possible chronic infections, included people who were known to have been bitten by triatomine vectors or who presented suggestive clinical pictures (involving myocardopathy, heart rhythm alterations, or megaviscera). Like the other 14 patients, these subjects provided complete clinical histories and blood specimens for serology, and were given an electrocardiogram and chest telerradiography or a heart X-ray series. In addition, in cases where Chagas' disease was suspected in hospitalized patients, biopsy or necropsy specimens were obtained for histopathologic examination.

It should be mentioned that routine laboratory examinations could only be performed on the hospitalized patients and some of the patients with confirmed cases. Patients with acute cases confirmed by finding *T. cruzi* parasites were treated with Nifurtimox at 8 mg per kg of body weight per day and were given follow-up electrocardiograms.

All of the specimen material was dispatched to the laboratories of the Department of Human Ecology at the UNAM Medical School in Mexico City, where it was processed as follows: The smears were stained with Giemsa and examined. The cultures were examined beginning at 15 days and thereafter every 15 days for two months. The sera were tested by complement fixation (CF) to 100% hemolysis, in accord with modifications introduced by the United States Centers for Disease Control (CDC) (13). The organ specimens were embedded in paraffin, and at least 10 serial sections were made of each organ.

Also, outside of this study population, a seroepidemiologic survey was performed on 52 children of both sexes selected at random from the primary school of San Felipe Yegachí, a locality near Miahuatlán with a total population of less than 500 inhabitants and

# RESULTS

## AND DISCUSSION

rural living conditions. The results of this survey were then compared with results obtained from a collection of serum samples taken from 52 children of the same age group in Mexico City.

Finally, 14 adult male sera obtained from blood given for transfusion in the rural hospital of Miahuatlán were examined, and the results were compared with those yielded by an equal number of sera obtained from blood given for use in Mexico City.

Triatomine bugs, used for xenodiagnosis of four acute cases from which *T. cruzi* had been isolated, were examined on day 15 after being fed, and thereafter every 10 days. (This examination consisted of collecting fecal specimens from the bugs and examining them microscopically for *T. cruzi* parasites.) After three months the bugs were killed and their intestines were macerated and subjected to microscopic examination. If none of these examinations detected parasites, the bugs in question were considered negative for *T. cruzi*.

As part of a complementary study, intradomiciliary insect vectors of Chagas' disease were collected at 10 Miahuatlán residences, including those of a number of subjects positive for *T. cruzi*.

As shown in Table 1, three (21%) of the 14 Miahuatlán patients presenting signs consistent with acute Chagas' disease were found positive for *T. cruzi* through visual observation of the parasite in fresh blood and in smears; the parasite was also detected through inoculation into rats and into NNN culture media. However, only one of the 71 patients with indications of chronic Chagas' disease (1.4%) yielded *T. cruzi* organisms. (This was to be expected, since it is recognized that the parasite is much harder to detect after the acute phase of the disease has passed.) In this case, the parasite was detected as groups of *T. cruzi* amastigotes in histologic sections stained with hematoxylin-eosin.

Table 1 also shows that one more acute case and seven more chronic cases—in addition to the four cases parasitologically confirmed—yielded positive

TABLE 1. Twelve cases of *T. cruzi* infection detected among the 85 Miahuatlán patients studied, either by observation of the parasite or by procurement of a positive response to the complement fixation (CF) test.

	No. of patients studied	No. parasitologically positive for <i>T. cruzi</i>	No. yielding positive CF results (including the four parasitologically positive for <i>T. cruzi</i> )
Suspected acute cases (in patients with some finding consistent with acute Chagas' disease)	14	3	4
Suspected chronic cases (in patients with some finding consistent with chronic Chagas' disease)	71	1	8
Total	85	4	12

**TABLE 2. Clinical, parasitologic, and serologic indications of chagasic infection among the 12 positive study subjects.**

Clinical, parasitologic, and serologic findings	No. of study subjects
Patients positive by CF, but without parasitologic confirmation of infection	
No clinical evidence of Chagas' disease	1
Clinical evidence of Chagas' disease	7
Patients positive by CF with parasitologic confirmation of infection	
Electrocardiographic changes observed, together with an anatomic and clinical picture consistent with Chagas' disease	3
Enteromegaly (megacigmoid) observed, together with an anatomic and clinical picture consistent with Chagas' disease	1
Total cases	12

CF test results. Table 2 presents summary data on the 12 cases involved.

As indicated in Table 3, CF tests for *T. cruzi* antibodies in 52 children 6 to 14 years old from the Miahuatlán area were positive in 46 (88%) of the cases. In contrast, all 52 sera from Mexico City children in the same age group were negative. The high percentage of positive reactions to the *T. cruzi* antigen among the Miahuatlán children suggests high risk and a high frequency of exposure to the parasite in the area.

Table 4 shows the CF results obtained with blood samples from donors in Miahuatlán and Mexico City. Again, a high proportion (78%) of the Miahuatlán sera tested positive, while all of the Mexico City sera were negative. These results give further grounds for considering the Miahuatlán region of Oaxaca as an area quite possibly endemic for Chagas' disease.

Of the four cases rated acute, three were confirmed by finding the parasite. The three patients involved were two boys 9 and 11 years of age (Photos 1 and 2) and a girl 14 years old, all with

**TABLE 3. CF test results obtained with sera from 52 San Felipe Yegachi schoolchildren 6-14 years old and 52 Mexico City children in the same age group.**

	No. of sera	Sera positive by CF	
		No.	%
Miahuatlán children	52	46	88%
Mexico City children	52	0	0%

**TABLE 4. CF test results obtained with sera from 14 adult blood donors in Miahuatlán and 14 others in Mexico City.**

	No. of sera	Sera positive by CF	
		No.	%
Miahuatlán donors	14	11	78%
Mexico City donors	14	0	0%

PHOTOS 1 AND 2. Two of the Miahuatlán study subjects with acute Chagas' disease, both showing Romaña's sign.



Romaña's sign. These subjects had positive CF titers of 1:8, 1:32, and 1:64, respectively; electrocardiographic changes indicating an incomplete block of the right branch of the bundle of His; and cultures positive for *T. cruzi* in NNN media.

All eight chronic cases yielded positive CF test results with titers ranging from 1:32 to 1:128; of these eight, six had clinical pictures and/or ECGs consistent with chagasic cardiopathy; four were asymptomatic; and two had left and right cardiac insufficiency with predominance of the latter (Photos 3 and 4).

One of the chronic patients had the first case of Chagas' disease involving a megasigmoid (Photo 5) that had ever been reported in Mexico. This patient, a male *campesino* 51 years old with a history of triatomine bites, came to the hospital with a picture of mild intestinal obstruction. Upon surgery, a large volvulus of the sigmoid was found, resected, and examined histopathologically. Aggregations of *T. cruzi* amastigotes were found in histologic sections. The patient's serum tested positive for *T. cruzi* by CF at a titer of 1:64.

As a supplement to this study, 87 triatomine bugs were collected in Miahuatlán and tested for *T. cruzi* (Table 5). Thirty of these insects were dead and 57 were alive. Of the live insects, 53 (92%) were positive for *T. cruzi*; none of the dead insects tested positive. All the dead specimens and most (50) of the 57 live specimens were of the *Triatoma barberi* species and were captured by hand in human dwellings, which attests to their domesticity. The other seven living specimens, belonging to the species *Triatoma gerstaeckeri*, were collected around homes, and five of these tested positive for *T. cruzi*. The finding of this latter

TABLE 5. Triatomine bugs collected in and around Miahuatlán residences.

	No. collected		No. of live bugs positive for <i>T. cruzi</i>
	Alive	Dead	
<i>Adults:</i>			
Males	23	11	21
Females	18	9	17
<i>Nymphs:</i>			
Males	8	4	6
Females	8	6	9
Total	57	30	53

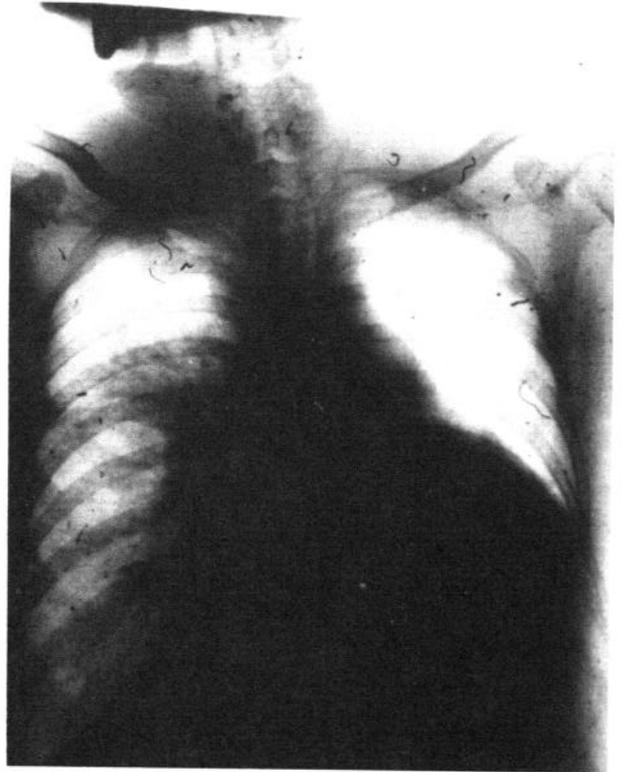
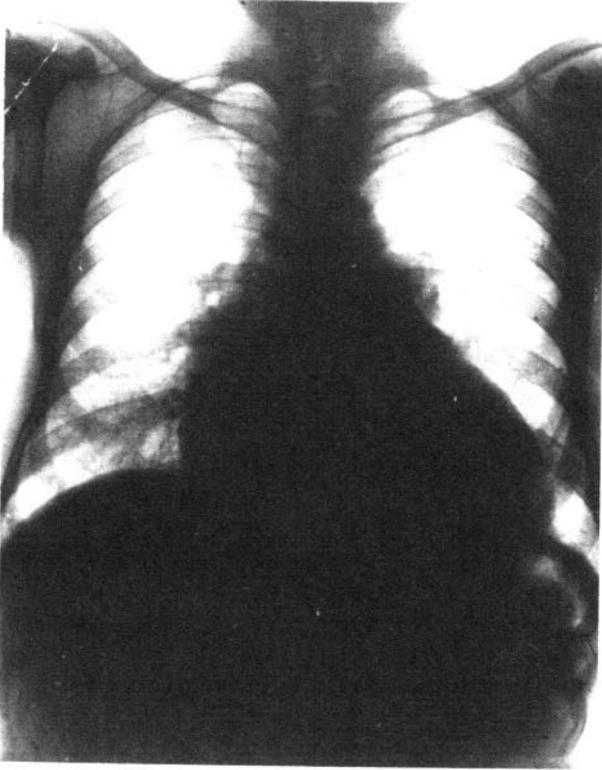
species (never before reported in Oaxaca State) so far south and so far away from the places in which it had been reported previously, appears to greatly extend the area of its known distribution.

## SUMMARY

A survey was made of residents and hospital patients in Miahuatlán, Oaxaca, Mexico, for cases of Chagas' disease. This survey focused primarily upon 85 patients attending the local hospital who had clinical pictures suggesting the disease, 14 with possible acute cases and 71 with possible chronic cases. In addition, sera from 14 Miahuatlán blood donors were examined; seroepidemiologic testing was performed with 52 sera from schoolchildren at another community nearby; and triatomine bugs were collected from Miahuatlán residences.

Each of the 85 patients provided a complete clinical history and blood specimen, and each was given an ECG and a series of heart X-rays or chest telerradiography. In some cases biopsy or necropsy specimens were obtained. A variety of parasitologic and serologic tests performed with these specimens indicated chagasic infections in four of the 14

**PHOTOS 3 AND 4.** Two of the Miahuatlán study subjects with chronic Chagas' disease showing cardiomegaly (grade III at left, grade IV at right).



**PHOTO 5.** Megacolon surgically removed from a Miahuatlán study subject with chronic Chagas' disease.



subjects with possible acute cases and eight of the 71 subjects with possible chronic cases. One of these latter subjects had the first case of Chagas' disease involving a megasigmoid that had ever been reported in Mexico.

A high proportion (78%) of the sera from Miahuatlán blood donors tested positive for *Trypanosoma cruzi* antibodies by complement fixation, as did 88% of the sera from the 52 schoolchildren. A total of 57 triatomid vector insects were captured alive and tested for *T. cruzi*. Most (92%) were positive for the parasite; and while most (50 of the 57) were specimens of *Triatoma barberi*, the capture of seven *Triatoma gerstaeckeri* insects appears to greatly extend the known range of the latter. Overall, the survey results (especially those involving the schoolchildren) demonstrate a high risk of exposure to *T. cruzi* in this area and give grounds for considering the Miahuatlán region of Oaxaca endemic for Chagas' disease.

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