

Cardiac morbidity due to Chagas' disease in a rural community in Bolivia

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SUMMARY

The prevalence of cardiac morbidity due to Chagas' disease was assessed in a rural community in Central Bolivia. Sixty-nine of 104 persons (66%) were seropositive to *Trypanosoma cruzi* by two serological methods. Two of 35 (6%) seronegative individuals presented with modest ECG alterations (left anterior hemiblock), but 21 of 69 (30%) seropositives showed modest and severe abnormalities (6 complete right bundle branch block, 2 polyfocal or frequent extrasystoles, 9 ischaemic ST alterations). A high percentage (56%) of domiciliary *Triatoma infestans* was infected with *T. cruzi*. There was a significant association between seropositivity and substandard housing. Priority preventive measures should thus include house improvement (to reduce bug infestation) and health education.

INTRODUCTION

American trypanosomiasis, or Chagas' disease, caused by the protozoan *Trypanosoma cruzi*, is a major public health problem in rural areas of Central and South America. It is estimated that there are between 10 and 20 million infected individuals in the region and that 65 million persons are exposed to risk (WHO, 1985). Chronic cardiomyopathy is a frequent consequence of infection and a leading cause of disability and mortality in endemic areas (Maguire *et al.* 1983). Cardiac lesions are mainly observed in the 20- to 40-year age-group and are characterized by electrocardiographic (ECG) abnormalities, e.g. complete right bundle branch block, cardiac failure, and sudden death (Moncayo, 1986). Up to 30% may present with ECG abnormalities in the chronic phase (Pereira *et al.* 1985; Kawabata, 1987). Prevalence and severity of the disease appear to be confined to certain geographical areas and attempts were made to correlate that with different strains or zymodemes of the parasite (Miles, 1983; Luquetti *et al.* 1986).

We therefore conducted a prospective study in a rural community in Bolivia (altitude 1800 m), to assess the relationship of electrocardiographic abnormalities and seropositivity to *T. cruzi* in a group of 20 to 30-year-old women. This was done according to WHO recommendations that the basis for a control program is a

survey of prevalence of human infection (WHO, 1985; Moncayo, 1986). The study therefore also included personal interviews to ascertain social background and living conditions.

MATERIALS AND METHODS

The study was made in an endemic area of Chagas' disease in Bolivia. Comarapa is the capital of the province Manuel Maria Caballero, Santa Cruz Department, and has about 2500 inhabitants. The town is situated on the eastern range of the Andes, altitude about 1800 m. It lies midway between the towns of Cochabamba and Santa Cruz (250 km from each). The population, mainly agricultural, is of mixed Spanish and Indian origin.

The study group was the local Mother's Club, a group of women who realize the need for protection from disease, sponsored by the staff of the hospital San Martin de Porres. The group investigated had no obvious clinical symptoms. We wanted to support the aims of the Mother's Club, that each woman might promote better health in her own family.

Sera were sent in a cooling box to Santa Cruz for serology. The complement fixation test (CFT) and indirect immunofluorescence (IFT) were performed with commercial test kits in the Instituto Bioclinico Central, Santa Cruz. Test kits were manufactured and supplied by the Romanelli Company, Buenos Aires, Argentina.

The results were judged to be positive only if both serological methods were positive. The ECGs were performed with a single-channel Siemens Cardiostat at a paper speed of 25 mm/sec. A standard 12-lead tracing and a 30-second rhythm strip were recorded. ECGs were coded independently by two cardiologically experienced physicians, by a modified Minnesota Code (Maguire *et al.* 1982). Classification of ECGs as abnormal was based on the following criteria: ventricular conduction defects, arrhythmias (repetitive or multifocal extrasystoles, bradycardia, supraventricular or ventricular tachycardia), ST and T alterations of ischaemic type, atrioventricular block, abnormal Q or QS waves, pattern of ventricular hypertrophy with ST segment and T wave alterations.

Personal interviews used a standard questionnaire and were conducted in the home of each woman by the senior author (T.W.).

RESULTS

A total of 104 women were examined with a median age of 27.3 years, ranging from 15 to 53 years. Serology was positive by both tests in 69 individuals (66%), and negative in 34 (33%); one further individual was positive by IFT but negative by CFT and is counted negative. Positivity increased with age (Table 1). The median age in the seropositive group was 28.5 years and 25.0 years in the negative group.

The overall prevalence of abnormal ECG was 23/104 (22%). An abnormal ECG was recorded more frequently in seropositive (21/69 = 30%) than in seronegative (2/35 = 6%) individuals (Chi-square test: $\chi^2 = 8.24$, D.F. = 1, $P < 0.05$). Abnormal ECGs did not correlate with 5-year age groups (Table 2). Detailed ECG findings are seen in Table 3. Complete right bundle branch block (RBBB) was

Table 1. Seropositivity to *T. cruzi* in 104 women according to age

Age (years)	Serology	
	Pos.	Neg.
15-25	30 (59%)	21 (41%)
26-35	26 (67%)	13 (23%)
36-45	10 (91%)	1 (9%)
> 45	3 (100%)	0

Table 2. Age distribution of 23 subjects with abnormal ECG

Age (years)	Abnormal ECG
15-20	4/20 (20%)
21-25	7/31 (23%)
26-30	4/27 (15%)
31-35	3/12 (25%)
36-40	4/7 (57%)
41-45	0/4 (0)
> 45	1/3 (33%)

Table 3. Abnormal ECG findings in 104 women

- 6 Left anterior hemiblock (LAH) (2 seronegative)
- 1 LAH and ischaemic ST alterations
- 1 LAH, ischaemic ST alterations and polyfocal extrasystoles (ES)
- 5 Right bundle branch block (RBBB)
- 1 RBBB and LAH
- 6 Ischaemic ST alterations
- 1 Ischaemic ST alterations, Es, and bradycardia
- 2 Bradycardia

strongly associated with seropositivity and occurred in 6/69 (9%) seropositive individuals. Left anterior hemiblock occurred in nine individuals, of whom two were seronegative.

Blood pressure, measured according to Riva-Rocci, showed a high level of hypotensives, but this was unrelated with *T. cruzi* seropositivity. The median measurements were 105 mmHg systolic and 68 mmHg diastolic.

The interviews revealed that house wall construction was clearly associated with triatomine infestations (Table 4); differences in wall condition between the two serological groups were significant (Chi-square test: $\chi^2 = 8.01$, D.F. = 2, $P < 0.05$).

Sixty-one women (59%) did not realize that triatomine bugs transmit disease, although they knew the bugs and had seen them in their houses; there was no significant difference in this knowledge between seropositive and seronegative persons.

The only bug species found was *Triatoma infestans*. Bugs had been collected from 8 representative houses, 52 bugs were found inside the houses, and 24 were infected with *T. cruzi* (46%); 82 bugs were found in the near surroundings of the houses, and 52 were infected with *T. cruzi* (63%). This difference was significant (Chi-square test: $\chi^2 = 3.86$, D.F. = 1, $P < 0.05$).

Table 4. Seropositivity to *T. cruzi* and wall construction

Wall construction*	Serology	
	Pos	Neg
Good	39 (57%)	29 (83%)
Medium	18 (26%)	2 (6%)
Bad	12 (17%)	4 (12%)
Total	69	35

* good: plastered walls, no cracks; medium: formerly plastered, now cracks; bad: never plastered, many cracks.

DISCUSSION

A high prevalence of seropositivity to *T. cruzi* and a significant association between pathologic ECG findings and seropositivity were observed in this rural population in Central Bolivia. Seropositivity to *T. cruzi*, especially if established by two different methods, has been shown to be a reliable indicator of infection with *T. cruzi* (van Meirvenne & Le Ray, 1985). On the other hand, ECG findings have certain limitations since there is no abnormality unique to Chagas' cardiomyopathy. Moreover, there are reports which indicate cardiac involvement even with normal resting ECG (Palermo *et al.* 1980). Nevertheless, the ECG is more sensitive than any other method in detecting cardiac pathology in Chagas' disease, especially in asymptomatic persons. There is a strong correlation between abnormal ECG and histological lesions (Oliveira *et al.* 1972; Andrade *et al.* 1978).

Our results are similar to those reported in Vallegrande, Bolivia (de Muynek *et al.* 1976). Both studies demonstrate that Andean valleys (1000–2500 m) are endemic for Chagas' disease, with high rates of cardiac morbidity. Studies from other countries show that the most common ECG alterations are ventricular conduction defects, namely right bundle branch block (Maguire *et al.* 1983; Kawabata *et al.* 1987). These findings are characteristic of populations in endemic areas. Why the lesions are located especially in the right bundle branch is still unknown. Of considerable interest is the high rate of ischaemic ST alterations, rather unusual in the 20–30 years age group. Such alterations are common in coronary artery disease, arterial hypertension, and old age. Since all these reasons do not apply to our group, one has to think of Chagas' disease as the cause for these lesions. Other studies had similar results but not such a high percentage of ST alterations (Maguire *et al.* 1983; Kawabata *et al.* 1987). Ischaemic ST alterations in a young age group in an endemic area should always raise the suspicion of Chagas' disease, except if other causes are detected.

Although seropositivity increased with age, this did not correlate with ECG results. Other studies showed a decline of abnormal ECGs with age, due to selective mortality (Mott *et al.* 1976; Maguire *et al.* 1983). Mortality statistics in endemic areas confirm high death rates due to Chagas' disease between the ages of 20 and 50 years (Prata, 1976). A retrospective analysis of a group of seropositive individuals followed over 18 years demonstrated that right bundle branch block was three times as common in fatal cases than in survivors. A definite reduction was seen in the life-expectancy of patients with atrial fibrillation and third-degree atrioventricular block (Dias & Kloetzel, 1968).

Polyfocal extrasystoles (as seen in two of our cases) can also lead to sudden death. The majority of infected individuals had normal ECGs, since most individuals are in the latent or indeterminate phase of the disease (Prata, 1976). Since most people acquire infection during childhood, a period of 10 to 20 years elapses before cardiac lesions occur, often at the most economically productive age.

Most important for the prevention of Chagas' disease are vector control, house improvement, health education and control of blood donors (Schofield, 1985). Vector control relies on insecticides; these are costly, toxic and their use requires an expensive infrastructure.

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