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Analysis of electrical heart alterations associated with chagas disease

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Abstract

Chagas disease, also known as American trypanosomiasis, is characterized by indirect human interaction with an insect vector. It is transmitted to humans through the feces of a triatomine bug (vinchuca), congenitally, via blood transfusion, orally, or through organ transplantation. The disease is named after its discoverer, Dr. Carlos Chagas, in 1909. The present study was conducted using a descriptive, cross-sectional design, as data were collected over a specific period from the target location, with the aim of analyzing cardiac alterations related to Chagas disease. The main objective is to analyze the electrical alterations of the heart associated with Chagas disease in patients from the South Health Network, Comibol Neighborhood, during the period from March to June. Ethical guidelines and considerations such as the Declaration of Helsinki were followed. The statistical software SPSS was used. Among the 63 electrocardiograms analyzed, most showed some form of alteration. The most frequent was a mild right QRS axis deviation (27%), followed by left axis deviation associated with hypertension (23.8%) and first-degree AV block (17.5%). Only 14.3% of the cases were normal. The ANOVA analysis showed statistically significant differences in mean age according to electrocardiogram (ECG) diagnosis ($F = 3.299$; $p = 0.026$), indicating that age varies depending on the type of electrical alteration detected.

Keywords: Electrical conductivity; Trypanosoma cruzi; Electrocardiography; Heart alterations; Prevalence

1. Introduction

Chagas disease, also known as American trypanosomiasis, is characterized by indirect interaction between humans and an insect. There are several ways in which the protozoan *Trypanosoma cruzi* (T. cruzi) can be transmitted to humans, including through the feces of the triatomine bug (vinchuca), congenitally, via blood transfusion, orally, through laboratory contamination, and by organ transplantation. [1] The insect vector is commonly known as *vinchuca*, with the scientific name *Triatoma infestans*. Chagas disease is named after its discoverer, Dr. Carlos Chagas, in 1909.

Trypanosoma cruzi has developed mechanisms to evade certain immune responses of the human body. The damage caused by the immune-inflammatory response may be related to myocarditis enriched with Th1-T cells, and high levels of interferon-gamma (IFN-γ) and tumor necrosis factor-alpha (TNF-α). [2] Chagas disease is known to be endemic in Latin America, with a significant impact in Bolivia, where it affects a large portion of the population."Chagas disease in Bolivia covers vast geographical areas of the Andean valleys and the Chaco region, which represent the most heavily infested zones." [3]

It has an incubation period of approximately 7 to 15 days when transmission occurs via the vector. There is a study by Hernández Pieretti, who conducted a clinical-epidemiological study at the Cardiovascular Disease Service of Hospital Vargas in Caracas, at the Chagas Disease Research Center in San Juan de Los Morros, and at Luis Razzetti Hospital in

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Barcelona, Anzoátegui State. The aim was to describe the most frequent electrocardiographic features in Chagasic cardiomyopathy. Among 100 patients with positive serology and signs of cardiomyopathy, the most significant electrocardiographic alterations found were: complete right bundle branch block (34%), incomplete right bundle branch block (15%), complete or incomplete left bundle branch block (19%), diffuse intraventricular conduction disorders (18%), and extrasystoles (63%), thus highlighting the most significant evolutionary changes in the electrocardiogram at different stages of the disease. [4]

Electrical conduction disorders in the heart follow a cascade-like process in affected patients. Infection by Trypanosoma cruzi (T. cruzi) initiates a complex sequence of alterations in cardiac myocytes, significantly disrupting heart rhythm and contractile function. [5] A study revealed that among the 1,304 participants, the median age was 60 years (51–69), of whom 872 (67%) were women. There were 93 individuals (7.1%) with LVSD (left ventricular systolic dysfunction). NT-proBNP was elevated in 148 individuals (11.3%) from the study population. The majority of the population presented significant electrocardiographic abnormalities (59.5%). [6]

Intraventricular conduction disturbances and QRS widening appear early in chronic Chagas cardiomyopathy (CCC), even before contractile abnormalities of the myocardium are evident. Therefore, they lack the prognostic value they have in other cardiopathies. [7] Electrical abnormalities manifest as rhythm and/or conduction disorders, segmental (more common) or global systolic dysfunction of the left ventricle (LV) with or without heart failure, and/or thromboembolic events. [8]

Chagasic cardiomyopathy may also present in a preclinical phase characterized by asymptomatic electrocardiographic abnormalities with preserved global left ventricular function. (9) In a clinical case study where Chagas disease was associated with tachycardia, the 7:44 p.m. electrocardiogram showed sinus tachycardia at 150 beats per minute conducted with right bundle branch block. The 8:35 p.m. electrocardiogram showed a heart rate of 35 beats per minute followed by a ventricular extrasístole. [10]

2. Methodology

This study was conducted using a descriptive, cross-sectional design, as data were collected over a specific period at the problem site, with the aim of analyzing cardiac alterations related to Chagas disease. The main objective is to analyze the electrical alterations of the heart associated with Chagas disease in patients from the South Health Network, Comibol Neighborhood, during the period from March to June. The study population consisted of 63 patients who underwent electrocardiographic examination, which generated results based on the reading of the heart's electrical parameters. The study also incorporated bibliographic support, organized using the data management software Zotero 9.

For data collection, an informed consent form was applied, in which each patient agreed to the publication and dissemination of results while protecting their identity. An interview was conducted using a structured questionnaire containing questions about lifestyle, clinical condition, and sociodemographic data to help identify potential patterns related to Chagas disease. Ethical guidelines and considerations were followed, including the Declaration of Helsinki. Furthermore, the study was previously approved by the Ethics Committee of the Universidad Nacional del Oriente.

The statistical software SPSS was used for descriptive analysis of variables through frequencies and measures of central tendency. Normality tests were conducted to ensure acceptable reliability of quantitative data. Inferential statistics were applied using parametric tests, specifically ANOVA, to evaluate variable correlations.

3. Results and discussion

Our study population consisted of patients receiving healthcare services in the Comibol neighborhood of Santa Cruz de la Sierra, Bolivia. A total of 63 patients were evaluated through electrocardiogram (ECG) studies to identify possible alterations in the normal functioning of the heart.

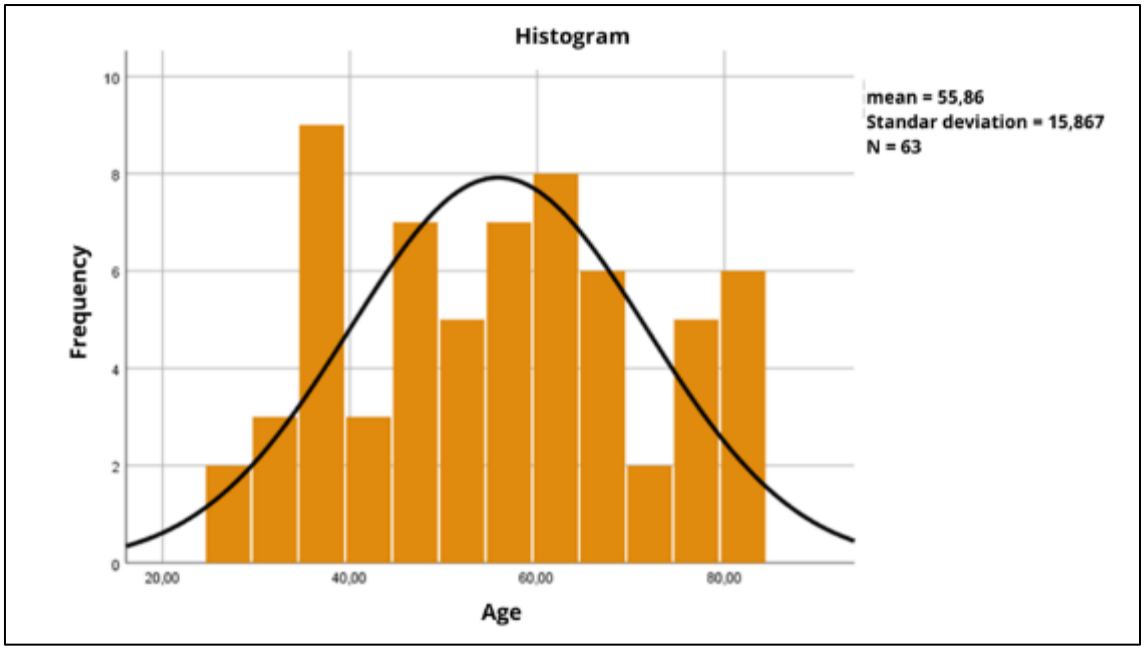

Figure 1 Mean Age

- Interpretation

The average age of the patients is approximately 56 years, with a median of 57, indicating a distribution centered near the mean. However, the presence of multiple modes and a relatively high standard deviation show some dispersion in ages.

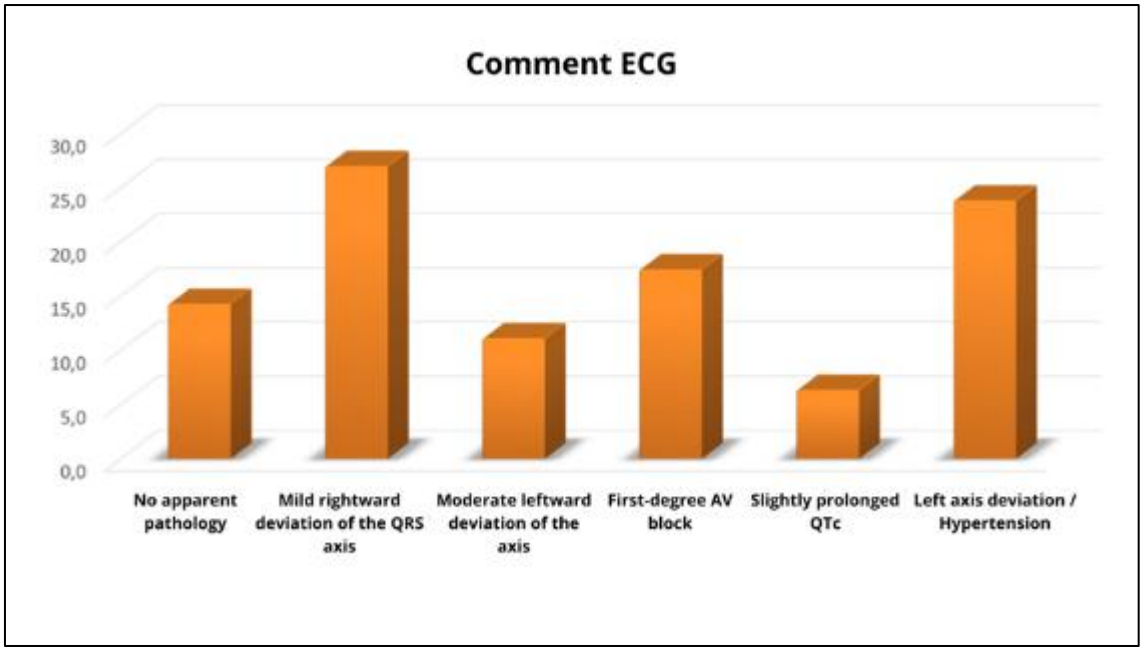

Figure 2 ECG Comments

- Interpretation

Of the 63 electrocardiograms analyzed, most showed some alteration. The most frequent was a mild rightward deviation of the QRS axis (27%), followed by left axis deviation associated with hypertension (23.8%) and first-degree AV block

(17.5%). Only 14.3% of the cases were normal, suggesting a high prevalence of electrical conduction disorders in this population.

Figure 3 Normality Test (Age)

- Interpretation

Since p = 0.200 (> 0.05), the null hypothesis is not rejected. This indicates that the age distribution does not differ significantly from a normal distribution. Therefore, the age variable is normally distributed, and parametric tests can be applied if necessary.

Table 1 ANOVA Test

ANOVA test

Age

	Sum of squares	gl	Mean square	F	Sig.
Between groups	2242,217	3	747,406	3,299	,026
Within groups	13367,497	59	226,568		
Total	15609,714	62			

- Interpretation

The ANOVA analysis showed statistically significant differences in mean age according to the electrocardiogram (ECG) diagnosis (F = 3.299; p = 0.026), indicating that age varies depending on the type of electrical alteration detected. However, Tukey's post hoc analysis did not reveal significant differences between pairs of groups (p > 0.05), although there was an increasing trend in mean age from patients with normal ECG (47 years) to those with severe alterations (62.9 years), which could suggest a relationship between older age and severity of electrical alteration.

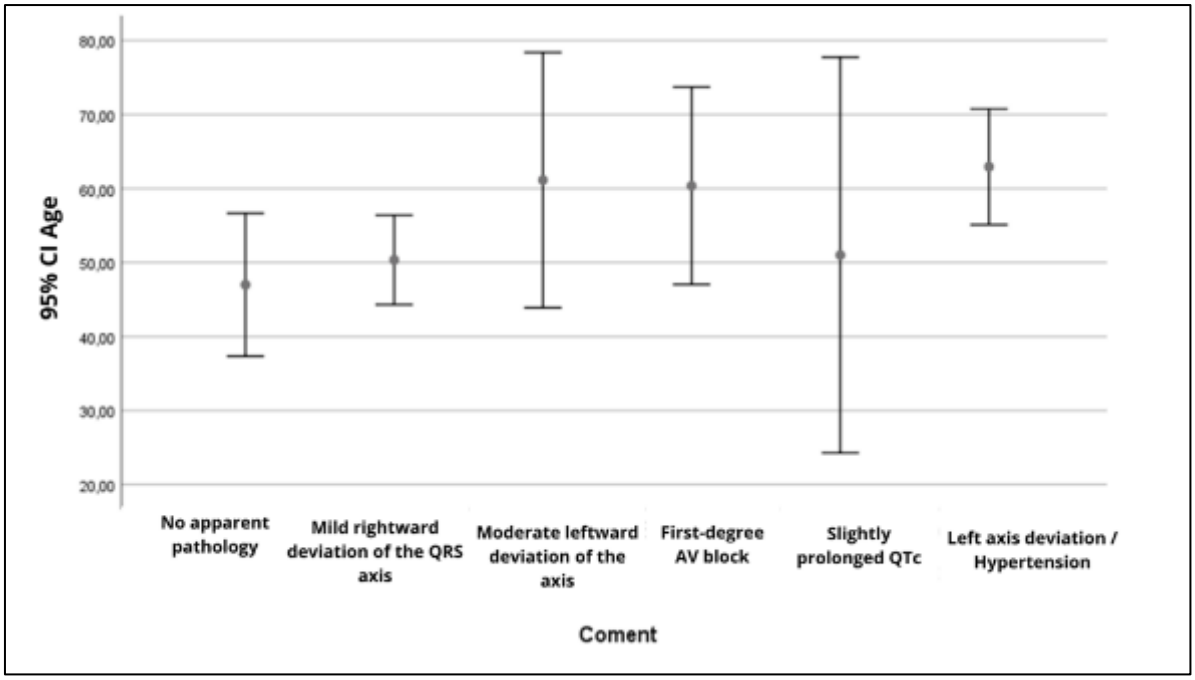

Figure 4 Confidence Interval of ANOVA Test

- Interpretation

This graph visually supports the conclusion that mean age does not differ significantly among the different types of ECG findings. The large overlap between confidence intervals reinforces that the observed differences could be due to chance.

4. Conclusion

Electrical alterations condition and generate cardiac pathologies. The most common conditions were identified according to the ECG comments. The statistical test for correlation between variables establishes a relationship between age and ECG findings.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflicts of interest were reported in the production and execution of this study.

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