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Association Between the Epidemiological Profile and the Heart Electrical Function of Patients with Chagas Disease

Lineker Fernandes Dias[1,*], Stefan Vilges de Oliveira[1]

ORCID ID

Dias LF https://orcid.org/0000-0002-6256-7139

Oliveira SV https://orcid.org/0000-0002-5493-2765

ABSTRACT

Objective: To analyze the association between the epidemiological profile and cardiac electrical function in patients with Chagas disease. **Method:** This is a descriptive, cross-sectional study, based on the analysis of medical records from a teaching hospital in Minas Gerais. The association of the epidemiological characteristics of the individuals included in the study with the results of their ECGs was analyzed. **Results:** 70 medical records were evaluated. Most of the sample was elderly (81.42), with a predominance of males (47.14%), and white ethnicity (50%). Left bundle branch blocks (18.57%) and left and right bundle branch blocks (11%), left ventricular overload (71.43%) and secondary changes in ventricular repolarization (21.43%) were the predominant electrophysiological changes. When checking the association between the epidemiological profile and cardiac electrical function, the only significant association was between the variables ethnicity and atrioventricular blocks (AVB). **Conclusion:** Among the residents of Minas Gerais with CD, elderly white men likely tend to develop AVB.

KEYWORDS: Epidemiology; Electrocardiography, ambulatory; Trypanosoma cruzi; Medical records.

INTRODUCTION

Chagas disease (CD) is caused by infection with the protozoan parasite *Trypanosoma cruzi*[1] and transmitted by insects of the triatomine family, which has more than 130 species[2]. The protozoan infection results in a systemic disease that in most patients becomes chronic[1,3].

It is estimated that between six and seven million people are infected with the protozoan parasite that causes CD worldwide. Most of them live in Latin America[4]. In Brazil, the number of people infected with CD ranges from 1.9 to 4.6 million[5-7].

In Brazil, between the years 1999 and 2007, 53,930 deaths were caused by complications of CD. Of these, chronic CD was the form of the disease most associated with cases of death (n = 43,302)[8].

Sudden death in patients with CD is mainly caused by atrial fibrillation and ventricular tachycardia[9,10]. These pathophysiological changes have been identified for several years in tests such as the electrocardiogram (ECG)[11],

which helps health care professionals identify heart failure in patients with CD[12]. Furthermore, studies indicate that changes in this test are an independent variable for the occurrence of strokes[13,14].

Patients with CD and with changes in their ECG have higher mortality rates than patients without these findings. Furthermore, these mortality rates are related to other epidemiological variables, such as age and sex of the patient with CD[15,16].

1. Universidade Federal de Uberlândia – Uberlândia (MG), Brazil.
***Correspondence author:** lineker-fernandes@hotmail.com
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More studies that evaluate the epidemiological profile of patients with CD are needed to understand the relationship between these variables[12], by conducting research that evaluates the manifestations of the disease in complementary exams, such as ECG, or even investigations that update the epidemiological knowledge of CD. In this way, it is possible to better understand the disease in a current scenario of climate and geopolitical changes with the potential to affect living habits of the CD vector and access to health care by patients with the disease[17].

Given the above, the hypothesis of this study is that there is an association between the epidemiological profile of CD patients seen at a university hospital in Minas Gerais and the presence of cardiac electrical function disorders in them. The overall objective of this research was to analyze the association between the epidemiological profile and cardiac electrical function in patients with CD.

METHODS

Descriptive, cross-sectional, document analysis research, developed in the statistics sector of the Hospital de Clínicas of the Universidade Federal de Uberlândia (HC-UFU).

The city of Uberlândia is located in Minas Gerais, in the Southeast Region of the country, and has an estimated population of 699,097 people. It is located in the mesoregion of Triângulo Mineiro and Alto Paranaíba[18].

The HC-UFU is located in the city and is a medium and high complexity hospital. The institution has 520 beds, which provide care to 86 cities in the Northern Triangle region, in Minas Gerais, and is considered the one that provides the most services via the Unified Health System in the state. It holds the rank of third largest university hospital under the Ministry of Education[19].

Study participants were selected from CD patients seen at HC-UFU from January 2015 to January 2020. The statistical sector of the institution where the research was carried out requested the medical records of the patients seen at the service during the period established for the study. No calculation centered on sampling techniques was performed to define the number of records to be analyzed. This number was defined by convenience, respecting the number of patients seen at the HC-UFU in the proposed period.

The inclusion criteria for this study were: patients who had in their medical records the serological diagnosis of CD, and at least one ECG in their medical records that could be interpreted or with a report.

The exclusion criteria were: illegible contents of the medical records, records of patients who were still institutionalized in the service, records that, at any time during the analysis, were requested by the service for use, and death of the patient.

The following epidemiological data in the medical records were analyzed: age; sex; race; profession; place of birth; residence; whether the patient had ever lived in a rural area. Race was subdivided according to the self-declaration definitions used by the Brazilian Institute of Geography and Statistics: white, black (or brown), yellow, and indigenous[20].

The patients' ECGs were evaluated in order to identify: heart rate; heart rhythm; interval from the end of the P wave to the beginning of the QRS interval; ventricular electric systole interval; period of inactivity between depolarization and repolarization of the ventricle; calculation of the electric axis; and the presence of sinus rhythm.

Then, the association between the epidemiological information and the ECG data collected in the medical records was verified using IBM Statistical Package for the Social Sciences (SPSS) software, version 20. For statistical analysis of the categorical variables, the χ^2 tests of adherence and independence were used[21]. For all statistical analyses, a 5% significance level was considered.

This research project was approved by the Research Ethics Committee of the Universidade Federal de Uberlândia, registered under opinion number 3.959.815. The entire conduct of the study sought to respect the guidelines of Resolutions No. 466, published on December 12, 2012, and No. 510, dated April 7, 2016, of the National Health Council[22].

RESULTS

A total of 70 medical records were analyzed. The characteristics of the sample analyzed are shown in Table 1.

Table 1. Epidemiological characteristics of patients with Chagas disease seen at the Hospital de Clínicas, Universidade Federal de Uberlândia, between 2015 and 2020.

Variables	Patients n = 70 (%)	p-value
Age group (years and %)		
80–89	18 (25.7)	0.647
70–79	20 (28.6)	
60–69	19 (27.1)	
≥ 59	13 (18.6)	
Sex		
Male n (%)	39 (55.7)	< 0.001
Female n (%)	31 (44.3)	
Ethnicity		
White n (%)	35 (50)	0.006
Black or brown n (%)	20 (28.6)	
Not described n (%)	15 (21.4)	
Have ever lived in a rural area		
Yes n (%)	18 (25.7)	< 0.001
No n (%)	20 (28.6)	
Not informed n (%)	32 (45.7)	
Birthplace		
Triângulo Mineiro n (%)	30 (42.9)	< 0.001
Alto Paranaíba n (%)	8 (11.4)	
Midwestern Minas Gerais n (%)	6 (8.6)	
Northwestern Minas Gerais n (%)	3 (4.3)	
Northern Minas Gerais n (%)	4 (5.7)	
Other states n (%)	11 (15.7)	
Not informed n (%)	8 (11.4)	

It is noteworthy that most of the sample is elderly, over 60 years old (81.4%). There is a predominance of males, whites, and residents of Triângulo Mineiro.

Except for the age group variable, the χ^2 adherence test on each of the epidemiological characteristics analyzed revealed that the obtained characteristics are not equally distributed among patients ($p < 0.050$).

The ECG characterization of these analyzed patients is shown in Table 2.

Heart rhythm in bradycardia, left bundle branch block and left and right bundle branch block, left ventricular overload and secondary ventricular repolarization changes were the predominant electrophysiological changes.

The χ^2 adherence test for each parameter evaluated on the ECG indicated that the test findings were also not equally distributed ($p < 0.05$).

When the association between the epidemiological profile and the cardiac electrical function of the patients was verified, based on the χ^2 test of independence, the content is shown in Table 3.

The χ^2 test of independence indicated that there is a significant association between the electrophysiological blocks observed in the ECG and the ethnicity of the patients, however the other epidemiological variables analyzed did not show a significant association with the parameters evaluated in the exam.

Table 2. Electrocardiographic characteristics of patients with Chagas disease seen at the Hospital de Clínicas, Universidade Federal de Uberlândia, between 2015 and 2020.

Variables	n = 70 (%)	p-value
Heart rhythm		
Sinus n (%)	33 (47.1)	< 0.001
Artificial pacemaker n (%)	24 (34.3)	
Atrial fibrillation n (%)	5 (7.1)	
Not described n (%)	8 (11.4)	
Heart rate		
Bradycardia n (%)	13 (18.6)	< 0.001
Tachycardia n (%)	3 (4.3)	
Normal n (%)	50 (71.4)	
Not described n (%)	4 (5.7)	
Electrophysiologic blocks identified		
Left bundle branch block n (%)	13 (18.6)	< 0.001
Right bundle branch block n (%)	4 (5.7)	
Left and right bundle branch block n (%)	11 (15.7)	
First-degree atrioventricular block n (%)	6 (8.6)	
Complete atrioventricular block n (%)	1 (1.4)	
Not described n (%)	35 (50)	
Signs of cardiac chamber overload		
Left atrial overload n (%)	13 (18.6)	< 0.001
Right atrial overload n (%)	3 (4.3)	
Left ventricular overload n (%)	50 (71.4)	
Not described n (%)	4 (5.7)	
Changes in ventricular repolarization		
Primary changes n (%)	14 (20.0)	< 0.001
Secondary changes n (%)	15 (21.4)	
Primary and secondary changes n (%)	4 (5.7)	
Not described n (%)	37 (52.9)	

Table 3. Statistical association between the epidemiological variables and the parameters evaluated in the electrocardiogram of patients with Chagas disease seen at the Hospital de Clínicas, Universidade Federal de Uberlândia, between 2015 and 2020.

Variables	Rhythm	Rate	Blocks	Signs of camera overload	Changes in ventricular repolarization
Age group	0.680	0.840	0.592	0.470	0.917
Sex	0.810	0.324	0.845	0.424	0.909
Ethnicity	0.055	0.968	0.047*	0.329	0.119
Have ever lived in a rural area	0.067	0.573	0.089	0.420	0.987
Birthplace	0.840	0.759	0.187	0.210	0.746

* χ^2 test of independence indicating statistical significance $p < 0.05$.

DISCUSSION

In this research most of the CD patients were elderly, white, and male. A descriptive epidemiological study that sought to evaluate cases of acute CD reported in Brazil between 2007 and 2018 identified that, of the total number of patients found (n = 2,704), the majority were also male individuals (53.6%). In this study, however, the predominant age group with the acute form of the disease was 20 to 39 years (33.4%), and the ethnicity most identified among patients was brown (76 %)[23]. Based on the divergence between these latter epidemiological characteristics of the mentioned study and the findings of this research, it is suggested that the patients in this investigation present not the acute but the chronic form of CD. Such a hypothesis can also be validated considering the older age of the patients found here and the fact that CD is a disease that manifests itself in an acute form and evolves, with the aging of the individual, to a chronic form[24].

Most of the patients in this study came from Minas Gerais, particularly from the Triângulo Mineiro and Alto Paranaíba; however, 18.6% were from other macro-regions of Minas Gerais and other states. Research that sought to evaluate the flow of patients in the Minas Gerais health services indicated that Uberlândia is a health hub that attracts residents from the Triângulo Mineiro and Alto Paranaíba regions of the state[25]. The findings of this research, however, reveal that the university hospital evaluated provides health care not only to patients coming from its usual macroregions. Therefore, there are inequalities in the distribution of reference services for the care of patients with CD in the state, culminating in the displacement of these patients to distant municipalities in the search for health care.

ECG changes in patients with DC are common findings[12]. A prospective cohort of 557 patients over 60 years of age with CD and living in Bambuí, a city in the South Region of Brazil, found similar findings to those of this study26. In the Bambuí sample, a predominance of first-degree atrioventricular block among participants (6.8%) and left ventricular hypertrophy (2%) was identified, when these findings were compared with other types of atrioventricular block and hypertrophy of other cardiac chambers in the same study. However, left bundle branch block was more prevalent in the Bambuí sample (23.2%), differently from the findings of this study. This divergence between the two samples of patients with CD from different regions of Brazil points to the uniqueness of electrocardiographic findings in patients with the same disease, in this case due to naturalness, life habits, and other associated comorbidities.

In support of the findings of this investigation, a systematic literature review that sought to evaluate the main electrocardiographic alterations in patients with CD indicated that the most common disorders reported in the literature were: 1st degree atrioventricular block, right bundle branch block, left bundle branch block, and atrial fibrillation[27]. All these physiological changes were identified in the 70 patients analyzed in this research. Similar to the systematic review, left bundle branch block was also the most reported in the patients evaluated here.

A significant association was found in this study between the ethnicity of the patients and electrophysiological blocks. A similar investigation that evaluated the ECG of 32,238 elderly North American patients indicated in these individuals a higher incidence of bundle branch blocks in white and non-Latino compared to black and brown patients[28]. Since the highest prevalence of patients seen in the mining hospital was also white patients, it is possible that such an electrocardiographic characteristic extends similarly to white Latin American patients.

The limitations of this study include the fact that the ideal sample size was not calculated to define the number of records to be evaluated. As a strong point, it is worth mentioning that medical records from a reference center for the treatment of CD and data from patients coming from a Brazilian state endemic for the disease were evaluated.

It is necessary to carry out more studies that evaluate the epidemiological profile and the ECG findings of patients with DC from other states in Brazil, in order to determine the profile of electrocardiographic changes expected in Brazilian patients with the disease.

CONCLUSION

Most of the individuals with CD identified in this study were male, elderly, and of white ethnicity. The main electrophysiological changes in their ECG were bradycardia, bundle branch blocks, and left ventricular overload.

A statistically significant association was identified between the electrophysiological blocks observed on the ECG and the patient's ethnicity.

AUTHORS' CONTRIBUTION

Conceptualization: Dias LF, Oliveira SV; **Investigation:** Dias LF; **Writing - Original Draft:** Dias LF, Oliveira SV; **Writing - Review and Editing:** Oliveira SV; **Supervision:** Oliveira SV.

DATA AVAILABILITY STATEMENT

The entire data set that supports the results of this study is available upon request to the Statistics Sector of the Hospital de Clínicas of the Universidade Federal de Uberlândia, for research purposes, since it is data from patients who were hospitalized in the institution under guarantee of medical confidentiality.

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