

Prevalence of Electrocardiographic Changes in Patients of Teleassistance Network of Minas Gerais, Minas Gerais, Brazil

Prevalência das alterações eletrocardiográficas nos pacientes da Rede de Teleassistência de Minas Gerais, MG, Brasil

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Abstract

The electrocardiogram is a tool widely used to track and detect heart disease, which are a major cause of death in Brazil. Some countries are using the capabilities of telemedicine to provide health care in situations where the distance is a critical factor, even in the case of cardiovascular diseases. The State of Minas Gerais, for example, account since 2006 with a telecardiology system, Alarm network of Minas Gerais, which already covers more than 90% of the population. This paper seeks to identify the main ECG changes in patients of Teleassistance Network of Minas Gerais. Were conducted a retrospective study, exploratory and descriptive of the electrocardiograms in the period from January to December 2011, the random sample consisting of 4,000 tests in relation to 318,387 exams with investigative reports in this database in 2011. This sample is also statistically proportional to the sum of the population of all municipalities that is directly related to each pole. All the tests in this sample who had ECG changes were grouped and analyzed in a quantitatively way. The primary electrocardiographic change found in all poles of the Alarm network of Minas Gerais was related to intraventricular locks (25.64%), followed by the cardiac arrhythmias (22.86%). In this way, the study results may provide subsidies to aid in the planning of public policy, helping to guide programs that promote a quality assistance in the area.

Keywords: Electrocardiography; Telemedicine; Cardiovascular Diseases.

Resumo

O eletrocardiograma é uma ferramenta muito utilizada para rastrear e detectar doenças cardíacas, que são uma das principais causas de morte no Brasil. Alguns países vêm utilizando os recursos da telemedicina para possibilitar cuidados à saúde nas situações em que a distância é um fator crítico, até mesmo no caso de doenças cardiovasculares. O Estado de Minas Gerais, por exemplo, conta desde 2006 com um sistema de telecardiologia, na Rede de Teleassistência de Minas Gerais, que já abrange mais de 90% da população mineira. O presente trabalho busca identificar as principais alterações eletrocardiográficas em pacientes da Rede de Teleassistência de Minas Gerais. Foi realizado um estudo retrospectivo, exploratório e descritivo dos eletrocardiogramas no período de janeiro a dezembro de 2011, a amostra aleatória composta por 4.000 exames, em relação aos 318.387 exames laudados nesta base de dados em 2011. Esta amostra também é estatisticamente proporcional à soma da população de todos os municípios que estão diretamente relacionados a cada polo. Todos os exames desta amostra que possuíam alterações eletrocardiográficas foram agrupados e analisados quantitativamente. A principal alteração eletrocardiográfica encontrada em todos os polos da Rede de Teleassistência de Minas Gerais foi relacionada aos bloqueios intraventriculares (25,64%), seguido das arritmias cardíacas (22,86%). Dessa forma, os resultados do estudo poderão fornecer subsídios que auxiliem no planejamento de políticas públicas, colaborando para nortear programas que promovam uma assistência de qualidade na área.

Palavras-chave: Eletrocardiografia; Telemedicina; Doenças Cardiovasculares.

Introduction

The electrocardiogram (ECG) is a record of cardiac electrical activity on the surface of the thorax⁽¹⁾. It is widely used to track and detect heart disease, being a low-cost tool⁽²⁾. The test is considered the gold standard for non-invasive diagnosis of arrhythmias and conduction disorders, as well as being very important in coronary ischemic, constituting a marker of heart disease⁽¹⁾.

According to the World Health Organization (who), ischemic heart disease and stroke accounted for 15 million deaths in 2015. Of these, 8,760,000 of people died from ischemic heart disease⁽³⁾. In Brazil, the circulatory diseases also represent the leading causes of deaths, accounting for 28.6 percent of all causes of mortality in 2015⁽⁴⁾.

Given this context and the significant impact of cardiovascular disease on the health budget, mainly in the high complexity, several countries have used the telehealth services as a tool to aid in the diagnosis and treatment of several pathologies^(5,6), even in the case of cardiovascular disease⁽⁷⁾. The diagnosis of chronic diseases in young adults is of extreme importance to the good prognosis and cardiovascular decompensation⁽⁸⁾.

In middle of 1960, the National Aeronautics and Space Administration (NASA) has made great strides in the area of telemedicine by the need to remotely monitor its astronauts⁽⁹⁾. Around 1990, with the advance of the Internet and the advent of personal computers, the efforts and the possibilities for the area have increased considerably. There were, however, many doubts about the system and reluctance of professionals about something that still looked new and with effectiveness and cost-benefit not proven⁽¹⁰⁾.

Few studies prove the cost-benefit of this new form of communication in health. However, there is a huge need to meet remote populations, especially in developing countries and in development. At this point, an

interesting work that can be cited is the developed in the State of Pernambuco, Northeast Brazil, in which the Nuclei of Telehealth Network (Network NUTES), coordinated by the Federal University of Pernambuco (UFPE), develops activities of Telehealth. The program provides tele-education, Teleassistance and remote management services in public health network in the State, with priority to Family Health teams⁽¹¹⁾.

The telemedicine system in Brazil appeared in the 60, and consists in the use of technology to enable health care in situations where the distance is a critical factor⁽¹²⁾.

Since 2006, the State of Minas Gerais account, with a telecardiology system in the Teleassistance Network of Minas Gerais (RTMG), which has as one of the guiding principles, the implementation of the telecardiology small costs in small towns of the interior of the Brazil, thereby reducing unnecessary referrals, improving the quality of care and reducing the cost of attention to health.

The RTMG have already deployed the services of telemedicine in 780 municipalities that they are linked to seven poles. The Federal University of Minas Gerais (UFMG) was called project coordinator polo being the responsible for the coordination with the poles of other institutions, State University of Montes Claros (UNIMONTES), Federal University of Juiz de Fora (UFJF), Federal University of Uberlândia (UFU), Federal University of Triângulo Mineiro (UFTM), Federal University of São João Del Rei (UFSJ) Campus Cent-West "Dona Lindu" (CCO) located in Divinópolis and in 2016 was incorporated the Federal University of the Vales of Jequitinhonha and Mucuri (UFVJM). It should be emphasized that the UFVJM polo was incorporated after the conclusion of this research.

Assuming that circulatory diseases are among the leading causes of mortality in Brazil and generate large costs to the budget of the

Ministry of Health (MH), mainly in high complexity, it is extremely important to monitor, to plan and intervene, reducing mortality and preventing health hazards in this area. So, wonders what are the ECG more prevalent changes?

Thus, the aim of this study is to analyze the ECG performed by Teleassistance Network of Minas Gerais in the period from January to December 2011, to get the prevalence of electrocardiographic changes.

Method

Were conducted a retrospective study, exploratory and descriptive of electrocardiograms in the period January-December 2011 in RTMG. In this period, the database has 318,387 exams with investigative reports by cardiologists, covered 658 cities and had 817 telehealth points, which represented 77% of the municipalities in the State of Minas Gerais.

The scaling of a sample was taken from the equation of the confidence interval for a proportion.

The confidence interval for a proportion is: $CI(p) = \hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}$, whereby \hat{p} is the sample proportion, $\hat{q} = 1 - \hat{p}$ e $z_{\frac{\alpha}{2}}$ is the critical value that corresponds to the desired level of trust $(1 - \alpha)^{(13)}$. The term $z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}$ is the margin of error (E). So, can be written that $z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}} \leq E$. Soon, isolating the n , we have:

$$n \geq \frac{(z_{\alpha/2})^2}{(E)^2} \hat{p}\hat{q}$$

In practice, it is reasonable that the error E to be chosen by the user is small, for example, 1% to 3%. The margin of error used here was 1.6%, in other words, $E = 0.016$. The confidence level was 95% ($1 - \alpha = 0.95$), then $\alpha = 0.05$ e $z_{0.05} = 1.96$. Was adopted $\hat{p} = \hat{q} = 0.5$, so, has the maximum value for $\hat{p}\hat{q}$, which ensures the greatest $n^{(13)}$.

Therefore, can be used samples of size $n \geq 3752$. Then, the study included 4000 tests selected through proportional random sampling in the period mentioned, which ensures that the sample is representative. The number of electrocardiograms drawn in each polo was proportional to the sum of the population of the municipalities that are directly related to each pole. Bioestat software 5.0 was used to obtain the sample⁽¹⁴⁾.

To select the sample tests and collect the information of interest in this study, were developed a software using the Matlab software⁽¹⁵⁾. Were excluded from the sample exams that lacked medical report and those that contained a request that the medical examination was held again due to possible interference and/or exchange of electrodes during the recording of the examination.

As the electrocardiogram Interpretation Guideline of Brazilian Cardiology Society - SBC⁽¹⁾, the ECG changes can be grouped into six categories: arrhythmias; overload of cardiac cameras; intraventricular locks; ischemia, injury and electrically inactive area; presence of artificial pacemakers; and other changes. Sample exams that showed the medical report electrocardiographic change were grouped for analysis.

The survey was conducted after approval by the Ethics on Research Committee of the Universidade Federal de Uberlândia (CEP/UFU) under Protocol No. 029/12. Considering the Teleminas Health project a program that during the study period included 658 municipalities in Minas Gerais and because it is a retrospective study, was dismissed by CEP the application of Free and Informed Consent Form (FICT) to all indirect participants of the search.

As was not obtained the signature of the FICS of the participants of the survey, was respected the confidentiality of the information and the anonymity, according to the Resolution No. 466/12 of the National Health Council- NHC⁽¹⁶⁾. It should be emphasized that the data were presented in your set.

Results and Discussion

The sample consists of 4000 examinations, covering the age group of 0 to 101 years, 2414 (60.35%) of female patients and 1586 (39.65%) of male patients.

It should be emphasized that these reports were established by cardiologists of the health program Teleminas and the electrocardiograms were carried out in a non-randomized, in other words, the scans are of patients who seeking accredited health units the RTMG and for some reason was prompted by the attending physician of own unit test execution.

There was a prevalence of 53.40% of exams with ECG report within the bounds of normality and 40.23% with some type of change.

Despite the record in the database that all the exams with investigative reports, 13 (0.33%) were without medical report and 242 (6.05%) contained a request that the medical

examination was held again due to possible interference and/or exchange of electrodes during recording of the examination.

A study⁽¹⁷⁾ performed with ECG from the same RTMG program in the year 2009, $n = 7709$ tests concluded that 56.87% of electrocardiographic findings were normal. Other research⁽¹⁸⁾ with electrocardiograms of the RTMG, $n = 290795$, tests found that 57.6% of electrocardiographic reports were normal and even noted a progressive reduction in the prevalence of normal tests with increasing age.

Os exames da RTMG que possuíam no laudo médico “alterações eletrocardiográficas” foram agrupados de acordo com a alteração em seis polos, visto que o polo UFVJM foi incorporado somente em 2016.

Table 1 and table 2 show the electrocardiographic changes and their Confidence Intervals (CI) for each RTMG polo. Table 3 presents the electrocardiographic changes and your CI for all the RTMG.

Table 1. Prevalence of electrocardiographic changes in the poles of Uberlândia, Uberaba and Divinópolis. Minas Gerais, Brazil, 2011.

Changes	Uberlândia		Uberaba		Divinópolis	
	<i>n</i>	CI(p)*	<i>n</i>	CI(p)*	<i>n</i>	CI(p)*
Arrhythmias	35	24.14 ± 6.97	27	18.24 ± 6.22	48	25.26 ± 6.18
Overload of cardiac cameras	1	0.69 ± 1.35	7	4.73 ± 3.42	16	8.42 ± 3.95
Intraventricular locks	37	25.52 ± 7.10	45	30.41 ± 7.41	45	23.68 ± 6.05
Ischemia, injury and electrically inactive area	3	2.07 ± 2.32	5	3.38 ± 2.91	4	2.11 ± 2.04
Presence of artificial pacemakers	2	1.38 ± 1.90	0	0 ± 0	1	0.53 ± 1.03
Other changes	67	46.21 ± 8.12	64	43.24 ± 7.98	76	40.00 ± 6.97

$$* p \pm z_{\alpha/2} \sqrt{\frac{p(1-p)}{n}} (\%)$$

Source: survey data

Table 2. Prevalence of electrocardiographic changes in the poles of Juiz de Fora, Montes Claros and Belo Horizonte. Minas Gerais, Brazil, 2011.

Changes	Juiz de Fora		Montes Claros		Belo Horizonte	
	<i>n</i>	CI(p)*	<i>n</i>	CI(p)*	<i>n</i>	CI(p)*
Arrhythmias	43	18.45 ± 4.98	103	23.62 ± 3.99	196	23.76 ± 2.90

Overload of cardiac cameras	13	5.58 ± 2.95	22	5.05 ± 2.05	49	5.94 ± 1.61
Intraventricular locks	68	29.18 ± 5.84	102	23.39 ± 3.97	210	25.45 ± 2.97
Ischemia, injury and electrically inactive area	11	4.72 ± 2.72	12	2.75 ± 1.54	42	5.09 ± 1.50
Presence of artificial pacemakers	0	0 ± 0	4	0.92 ± 0.89	7	0.85 ± 0.63
Other changes	98	42.06 ± 6.34	193	44.27 ± 4.66	321	38.91 ± 3.33

$$* p \pm z_{\alpha/2} \sqrt{\frac{p(1-p)}{n}} (\%)$$

Source: survey data

Table 3. Prevalence of electrocardiographic changes in 2011 in all Poles. Minas Gerais, Brazil, 2011.

Changes	Total	
	n	CI(p)*
Arrhythmias	452	22.86 ± 1.85
Overload of cardiac cameras	108	5.46 ± 1.00
Intraventricular locks	507	25.64 ± 1.92
Ischemia, injury and electrically inactive area	77	3.89 ± 0.85
Presence of artificial pacemakers	14	0.71 ± 0.37
Other changes	819	41.43 ± 2.17

$$* p \pm z_{\alpha/2} \sqrt{\frac{p(1-p)}{n}} (\%)$$

Source: survey data

The highest prevalence of updates on all poles is related to intraventricular locks, of all, 25.64% of exams changed fall into this classification.

The Left Branch Block (LBB) is a type of intraventricular block that has been found in 55.82% of tests with intraventricular locks the RTMG. The prevalence increases with age, occurs infrequently in healthy young people⁽¹⁹⁾.

The LBB, in usual form, occurs in patients with previous heart disease and may be associated with progressive conduction system disease⁽²⁰⁾. Approximately 30% of patients with heart failure have LBB, and around 70% of patients who develop LBB, had prior evidence of left ventricular overload on the electrocardiogram⁽²¹⁾.

The LBB is associated with increased risk of cardiovascular mortality for heart attack and heart failure⁽²⁰⁾.

The Right Branch Block (RBB) is also a type of intraventricular block, being found at 41.81% of research tests that showed intraventricular block. This type of lock is a common finding in the general population, your also prevalence increases with age and occurs in many people without evidence of structural heart disease⁽¹⁹⁾.

The high prevalence of RBB is associated with weakness in the right branch⁽²⁰⁾. Some diseases can cause RBB, as: *cor pulmonale*, pulmonary embolism, ischemic stroke and cardiac infarcts, myocarditis, hypertension, cardiomyopathies and congenital heart disease⁽¹⁹⁾.

Has to be considered that the State of Minas Gerais is considered one of the Brazilian States with the highest prevalence of Chagas endemic and the RBB is the more frequent disorder of this type of heart disease.

The second most prevalent electrocardiographic changes on all poles was

to cardiac arrhythmias, corresponding to 22.86% of the studied population.

Arrhythmias are changes in heart rate that most often occurs unexpectedly. The arrhythmia may originate at the top (atria or supraventricular) or at the bottom of the heart (ventricles). Among supraventricular arrhythmias, are included: the atrial ectopy, tachycardia, atrial flutter and atrial fibrillation. Atrial fibrillation is quite common in clinical practice. This is a change in the heart rate, with quick contractions and not coordinates the atria, which reaches a large part of the elderly population. In the ventricles, the most frequent is extrasystole⁽²²⁾.

A research⁽²³⁾ held in the city of São Paulo, reveals that 21000 people are affected by sudden death each year, being 20% as a result of heart problems. It is estimated that, in Brazil, an estimated 212,000 people die of this cause per year, 90 percent of them because of cardiac arrhythmia can be treated if diagnosed in time.

The prevention of arrhythmias involves, besides the practice of physical exercises and balanced diet (low intake of salt and fats), regular medical assessment and the control of risk factors for diseases such as: diabetes, obesity, hypertension and smoking⁽²²⁾.

Conclusion

From the sample of 4000 electrocardiograms from RTMG, who had in the medical report electrocardiographic change (40.23%) were grouped according to each change. Of these, the primary electrocardiographic change found in all poles was related to intraventricular locks (25.64%), and the LBB is related to 55.82% of cases and the RBB to 41.81% of cases. Generally, the LBB occurs in patients with previous heart disease and the prevalence increases with age. The RBB also increases the prevalence with age and is a common finding in the general population.

Arrhythmias (22.86%) correspond to the second amendment most prevalent in electrocardiographic all Poles. Subsequently,

changes of cardiac overload (5.46%); ischemia, injury and electrically inactive area (3.89%); and the presence of artificial pacemakers (0.71%).

However, the study results may provide subsidies to aid in the planning of public policy, helping to guide programs that promote a quality assistance in the area. In this way, can contribute to a reduction in the rates of mortality from circulatory diseases and avoid the significant overhead in the MH budget on attention of high complexity, through prevention and/or control of diseases in health.

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