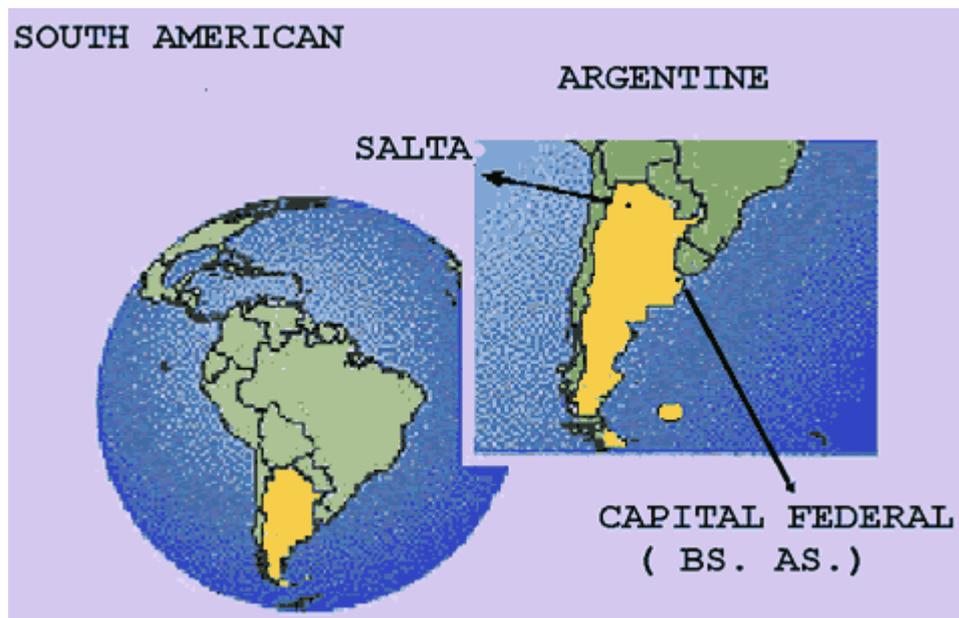


Electrocardiographic Alterations in Young People Seemingly Healthy

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MAP (Fig 1)



According to the *Dirección de Estadística e Informaciones de Salud* (Health Statistics and Information Office), in the *Ministerio de Salud y Acción Social de la Nación* (Argentine Health and Welfare Ministry) (1) the first cause of death in Argentina corresponds to the **Circulatory System Diseases** group. They amount to a 34.27% (96,028) from the total 280,180 deaths in 1998.

The same vital statistics display in Table 33 the **Death Causes in Circulatory System Diseases**: Acute and chronic rheumatic fever: 283 (1.29%).- Hypertensive diseases: 4,358 (4.53%).- Acute myocardial infarction: 16,492 (17.17%).- Other heart ischemic diseases: 5,236 (5.45%).- Cardiopulmonary and pulmonary circulation disease: 763 (1.83%).- **Other heart diseases: 38,573 (40.16%)**.- Cerebrovascular diseases: 23,647 (24.62%).- Artery, arteriole and capillary diseases: 4,647 (4.8%).- Venous phlebitis, embolism, and thrombosis: 132 (0.13%).- Rest of circulatory system diseases: 447 (0.46%).

So, the first cause for cardiac death is "Other heart diseases", which represent a 40% of deaths with a cardiac origin.

Recently, in a communication to the First Virtual Congress of Cardiology, Bocchi points out (2) that casuistry in heart transplantations gathered from 16 centers, since 1984 to 1999, amounted to 835 patients, the causes for their transplantations being: 1st **idiopathic dilated cardiomyopathy: 407 patients**, 2nd ischemic heart disease: 196, 3rd chagasic heart disease: 117, and 4th valvular heart disease: 29 patients. We find it remarkable that the most frequent transplantation indication turns out to

be dilated cardiomyopathy without a known cause.

The works on Chagas Disease are very numerous. We will mention only the epidemiological ones that could be compared because they used similar investigation criteria. These studies provide information on Chagas heart disease prevalence, mortality and lethality regarding those individuals infected by *Tripanosoma Cruzi*. (3, 4, 5, 6). However, in the statistics from the above quoted Newsletter (1) 644 deaths due to Tripanosomiasis are mentioned (0.22%), and 385 (0.13%) due to Chagas disease from the total deaths per year, which are not included among those due to heart causes.

In this work we are concerned with the 38,573 deaths due to "other kinds of heart diseases", which are neither coronary nor chagasic, nor congenital (these are in another section from the above mentioned Newsletter, and they are 1,237 deaths) nor valvular.

Together with Martino, while studying *Guarani* aborigines (of extreme poverty), we found three diseases per individual in average. If among them there was Chagas disease, a 92% had pathologic ECG. If they did not suffered American Tripanosomiasis, a 52% had ECG disorders with similar characteristics (7).

In blood banks from the Argentine Mesopotamia, while studying 1,965 individuals (19-45 years, both sexes), we found a 7% of alterations in non Chagasic people (8).

Recently, in Santa Fe, Arias (9) pointed out regarding pre-conscripts, a 6.3% of alterations in non chagasic individuals and an 11.5% in chagasic ones. These electrocardiographic studies carried out with reading criteria normalized in year 1984 (10) indicate a prevalence of non chagasic ECG alterations with unknown causes.

In 1994, Manzullo et al (11) studied the prevalence of ECG alterations in 1,673 18-year-old males from the City of Buenos Aires (Argentina), discovering that a 3.6% of the individuals studied presented alterations in the highest hierarchy as indicator of cardiac pathology, which cannot be attributed to Chagas disease, and the causes of which are unknown to us.

The amount of deaths quoted in the Official Newsletter, and those transplanted with unknown causes (Bochi), lead us to assume two possibilities: 1st: there is a pronounced subdiagnosis for well known causes (coronary, arterial, Rheumatic Fever, congenital, chagasic, etc.); 2nd there is a certain subdiagnosis and a presence of multiple causes that lead to cardiopathy and death that, at least in our country, have not been valued in their epidemiological magnitude.

Bibliographic quotations on dilated myocardiopathies with infectious causes are very numerous, but are always related to small groups of people. Because of this, the Committee of Experts of the WHO (12) requested as early as 1985, to organize population studies with simple techniques to be applied in developing countries and areas, in order to identify early cases and to be able to define the natural history of these diseases.

Heart diseases' influence as cause of death, a 40% of them with unknown causes, lead to search for the presence of ECG alterations in a young population to organize them in hierarchies and thus identify groups with risks of cardiopathy.

In September, 1994, on the occasion of the competence medical examination for military service, we applied our method of study in different regions. We mentioned the one from Capital Federal (11), and here we introduce the one from the Province of Salta (endemic area for Chagas), carried out in the City of Salta by the Army, who authorized to perform the whole study.

According to the 1991 National Census, the 18-year-old male population who lived in the mentioned province were 7,900, from which by a random sample, military authorities called 907 young men (11.5%).

Afterwards, by deficiencies in ECG tracings, 5 were removed, resulting in a 902-man representative sample.

On all of the young men presented, a blood sample was extracted for Chagas serology study by the staff of the specialized province laboratory, and under the guidelines of the *Instituto Nacional de la Enfermedad de Chagas "Dr. Mario Fatala Chaben"* (National Institute for Chagas Disease "Dr. Mario Fatala Chaben"). Those that were positive resulted from diagnosis confirmation by Immunofluorescence.

The conditions established by the "ECG Obtaining Guidelines" were applied(10). The electrocardiographic equipment used was standardized according to:

Conditions: velocity control in 25mm. per second (variation 1%)

Drop of base line: 1/16 cm.

Standard 1 cm. = 1 mV. Right angles.

The paper used had the same 45 mm. width and trademark than the one used in the Buenos Aires study.

The technicians responsible for making the ECG were trained following the "Record Obtaining Guidelines" (10), recording the data from each individual examined in an epidemiological file, adding the Chagas serology result.

The 902 ECG tracings, identified with first and last name, and DNI (*Documento Nacional de Identidad* - National Identity Card) were submitted to the CIE (*Centro de Investigaciones Epidemiológicas* - Epidemiological Research Center) in the Academia Nacional de Medicina for its reading.

STATISTICAL ANALYSIS

Frequency tables were made up for the different types of ECG alterations, as well as 2 for 2 tables to analyze the possible association between the "ECG alteration" and "Chagas serology" variables. The possible association was analyzed by the "Chi-squared" test with a degree of freedom of 1, with Yates correction for continuity, accepting the statistical association when the result was 3.84 or more. In order to quantify the importance of signification, the Relative Risk (RR) of ECG alteration when there is a positive Chagas infection was estimated, as well as the RR Confidence Interval for a 95%. Admitting the possibility that some of ECG alteration and positive serology cases could correspond to other causes, Population Attributable Risk was analyzed.

[Table 1](#) shows the 902 ECG distribution according to alterations presence or absence, according to "ECG Diagnosis Criteria and Nomenclature" (10), finding alterations in 188 ECG (20.8% from the total).

Table N°1	
SALTA: SAMPLE AND ECG ALTERATIONS	
Obtained E.C.G.:	902
Without Alterations:	714 (79,2%)
With Alterations:	188 (20.08%)

[Table 2](#) presents the different types of alterations found, mentioning the isolated alteration, and the alteration associated to its respective frequencies. The total number of alterations is 207, exceeding the number of individuals (188) that present them. This is due to the association of two alterations in one person.

Table N°2
Frequency of ECG alterations isolated and associated

Tra storms	Abbrev.	ISOLATED	ASSOCIATE	Total
Incompl. Right Bundle Branch Block	IR.B.B.B.	61	8	69
Sinusal Bradycardia	Sin.Br.	39	7	46
Sinusal Tachycardia	Sin. Tach.	31	5	36
Compl. Right Bundle Branch Block	C.R.B.B.B	16	3	19
Sinusal Arrhythmia	Sin. Arr.	10	2	12
1° Repolarization Alterations	1°Rep. Alt.	8		8
Pre excitation Syndrome	W.P.W.	2	1	3
Isolated Ventri.Extrasistole	Isol.V.EX	3		3
1° Grade A.V.Block	1°GRA-V B	2		2
Frecuent Ventr. Extrasistole	Frec.V.Ex.	2		2
Right Ventr. Hypertrophia	R.V.H.	2		2
Left Ventr. Hypertrophia	L.V.H.	2		2
Pulmonar P.	Pulmonar P	1		1
Incompl.Left Bundle Branch Block	IL.B.B.B.	1		1
Left Auric. Enlargement	L.A.E.	1		1
TOTAL		181	26	207

The summary of alterations, is higher than the number of persons with them, by associations.

[Table 3](#) points out that from 714 ECGs "without ECG alteration", 34 (4.8%) had positive Chagas serology. In the 188 "with ECG alteration", the serology was positive in 19 (10.1%). From the subjects with ECG alterations, 169 (89.9%) had no positive Chagas serology.

Table N°3
Distribution of the 902 studied.
ECG Alterations and serology for Chagas

	ALTERATED	NO ALTERATED	TOTALS
CHAGAS +	19	34	53
CHAGAS -	169	680	849
TOTALS	188	714	902

Given the 53 that were positive for Chagas, from which 19 had ECG alterations, the association between the variables was investigated by:

- 1- The Chi-squared was statistically significant, with a 6.35 value with $p < 0.05$.
- 2- The Relative Risk of having an alteration in the ECG when serology was positive. The RR was 2.09 with a 95% Confidence Interval, ranging from 1.22 to 2.65, thus confirming the existence of an association between serology and the presence of ECG alterations.

In [Table 4](#) the distribution of ECG alterations corresponding to the 19 individuals with positive Chagas serology, is displayed. The possible association of serology to the "Incomplete Right Bundle Branch Block" was studied, resulting statistically positive with a Chi-squared of 5.61 with $p < 0.05$ and a 2.40 RR with a Confidence Interval from 1.36 to 4.57. A similar analysis with "Complete Right Bundle Branch Block"

resulted in a Chi-squared of 18.68 with $p < 0.001$ and 7.39 RR with a Confidence Interval from 2.93 to 18.68.

Table N°4
DISTRIBUTION OF ECG ALTERATIONS AND POSITIVE CHAGAS

ALTERATIONS	N ^a
I.R.B.B.B.	9
C.R.B.B.B	6
Isol.V.EX.	1
Sin.Tach.	1
Sin. Arr.	1
1°Rep.Alt.	1
Total	19

In [Table 5](#) a group of ECG alterations was picked up and described as hierarchy indicators for cardiac pathology. The 41 young men that presented these alterations make up a 4.5% of the sample. The "Complete Right Bundle Branch Block" constituted the most relevant alteration with a 2.1% (19 cases). From them, a 0.66% (6 cases) had positive Chagas serology and a 1.44% (13 cases) were negative.

Table N° 5
ALTERATIONS BY HIERARCHY

ALTERATIONS	N°	%
C.R.B.B.B.	19	2,1
1° Rep.Alt.	8	0,8
W.P.W.	3	0,3
L.V.H.	2	0,2
Frec.V.Ex.	2	0,2
1°Gr. A-V. B.	2	0,2
R.V.H.	2	0,2
L.A.E.	1	0,1
L.A.H.B.	1	0,1
Pulmonar P	1	0,1
TOTAL	41	4,3

COMMENTS

1- Conventional ECG with 12 derivations is a very good element for population cardiologic studies as

long as strict Guidelines for ECG obtaining and reading are followed.

2- Any modification to a normal ECG is expressing some cardiac alteration, in a higher or lower hierarchy, regarding its significance and prognosis.

In this 18-year-old population, we considered the following to have less pathologic value: isolated supraventricular arrhythmias, tachycardias below 109, bradycardias over 46 per minute, and isolated ventricular extrasystole (less than three in the tracing). A group of 89 individuals had these alterations, corresponding to a 9.86% of the 902 studied.

3- The incomplete RBBB is worth mentioning: it was found isolated or associated in 69 (7.65%) of the 902 people studied (criteria: wide S in DI, rSR in V1-V2, QRS from 0.10 to 0.12). In Salta from 69 incomplete RBBB, 9 corresponded to Chagas. Its presence is therefore, not a required indicator for Chagas. But its RR is from 3 to 1.

4- In Salta, 53 young men had positive serology for Chagas (5.87% of the sample). A group of 19 had ECG alterations. We ordered 7 in a hierarchy, a 0.77% (7.7×1000) that presented complete RBBB (6) and primary repolarization disorders (1) as the most probable indicator for Chagas myocardialopathy.

In endemic areas, the complete RBBB is a strong indicator for probable Chagas etiology, with a RR from 7 to 1 for this disease.

However, among all of the 902 young men, we diagnosed 19 complete RBBB from which 13 had not positive Chagas serology, and must be necessarily attributed to other causes.

5- We want to mention here some data, which with identical methodology we published in 1998 (11) on 1,673 18-year-old males from Capital Federal, Argentina. A 27.6% (461 individuals) presented some ECG alteration. A 3.64 (61 individuals) had alterations we considered of a high significance.

Serology for Chagas in Capital Federal was present in 29 from the 1,673 males studied, that represented a 1.7% from the total. Eight had ECG alterations (Incomplete RBBB=2, Sinus Tachycardia: 1; Sinus Bradycardia: 1; LAHB: 1; Repolarization Alterations: 1; Inactivation: 1; Incomplete RBBB and Sinus Tachycardia: 1).

In the Capital Federal study, 12 (0.71%) Complete RBBB were diagnosed, none with positive Chagas serology. Therefore, there was no relationship between both.

We also mentioned the diagnosis of 233 Incomplete RBBB, 3 of which presented positive serology for Chagas.

The Chi-squared showed that in this sample there is no association between Incomplete RBBB and Chagas.

In these works, we think that it is possible to differentiate Salta as an endemic zone for Chagas where the Complete RBBB can be found in Chagasic patients in a 6 to 1 ratio against those who are not, and Incomplete RBBB in a 3 to 1 ratio. In Capital Federal, as a non endemic zone, neither Complete RBBB nor Incomplete RBBB are statistically related to Chagas.

6- It is worth mentioning the WPW, which was diagnosed in 9 young men in Capital Federal (0.5%), and 6 in Salta (0.3%). In our studies we found WPW with a 3 to 5 per 1000 prevalence.

7- Returning to Salta, and as we pointed out in the introduction, the objective of this work is to seek for ECG alterations in young men, to quantify them and order them in a hierarchy to try to advance in the knowledge of the existence of subclinc cardiac conditions, which can partially explain in a future the first cause of cardiac death: "Other heart diseases" that represent a 40%.

There are 41 individuals (4.5%) from the 902 who were studied (in Capital Federal: 3.6%) who presented alterations that according to our hierarchy (with the aim of obtaining more specificity) are more solid indicators of myocardial damage.

8- By applying the Population Attributable Risk, it was possible to estimate in the total group of men with ECG alterations and positive Chagas serology, how many of them were really due to infection, and how many can be attributed to other causes. Thus, from the 19 cases with ECG alterations and positive Chagas (Table 3), only a 44.5% were due to infection, and the remaining 55.5% were due to other causes. Similar estimations were made for complete RBBB and incomplete RBBB by their frequency. In the 6 complete RBBB cases with positive serology, an 86.5%, i.e. most of them, can be attributed to infection, and only a 13.5% to other causes. In regard to the 9 incomplete RBBB cases with positive serology, 58.4% can be attributed to infection, a 41.6% being due to other causes. These analysis is showing us the significance of studying these "other causes".

9- Finally, we want to emphasize that 31 individuals, a 3.36% of all those studied, presented ECG alterations of cardiopathy, which are not WPW, and do not have positive serology for Chagas, and the causes of which we ignore: Right ventricle hypertrophy: 2; Pulmonary P: 1; Left Ventricular Dilatation: 1; 1st degree AV block: 2; Incomplete Left Bundle Branch Block: 1; Frequent Ventricular Extrasystole: 2; Repolarization Primary Alterations: 7; Complete Right Bundle Branch Block 13; Left Ventricular Hypertrophy: 2.

These 31 individuals can develop later part of myocardioopathies proper to adults, or maybe they are already in such group.

To summarize, we point out once again, the significance of the relationship between Chagas and ECG alterations. However, when a young population seemingly healthy was studied (Blood Banks in Argentine Mesopotamia, 18-year-old young men in Bs. As. and Salta) a 3% was found with ECG alterations that indicate cardiac affections, the causes of which we ignore, and must necessarily be traced back to childhood or youth.

They may be congenital, metabolic or infectious. There is leafy bibliography on all of them, many are descriptive, and fewer indicate prevalence.

We believe it is very important and necessary to perform population studies in youth and childhood with noninvasive methods such as ECG, to detect and if possible to clarify the causes of these discoveries.

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