Assessment of the electrocardiograms performed in the Emergency Department of the Karl Heusner Memorial Hospital.

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Abstract
Background: The electrocardiogram (ECG) is a non-invasive technique that has not been replaced due to the information it provides.
Objective: Correlate the automatic reports provided by the device with the cardiologist's criteria, classifying them into normal and with changes, defining the latter. By recognizing cardiac emergencies using ECG, treatment strategy can be improved.
Material and method: A retrospective study of 557 consecutive ECGs performed in the Emergency Department of the Karl Heusner Memorial Hospital during 90 days was carried out. Different variables were analyzed such as: age, sex, normal traces and with changes, machine-specialist report correlation, and types of electrocardiographic abnormalities.
Results: ECGs were performed on 8.9% of the attendees, for an average of 6.2 studies per day, of which 50.8% were normal, according to the assessment of the expert and changes were observed in 49.2%. There was a machine-specialist agreement in 83.3% of the studies performed. In those with changes, 22.6% were arrythmias with sinus tachycardia (41.6%) being the most frequent; conduction disorders were detected in 13.8% with left bundle branch block predominating (16.9%); 11.1% had increase of chamber size, and 5.0% showed ischemic changes.
Conclusions: The correlation between machine and specialist was 83.3%. More than half of the ECGs were normal when adding the tracings with changes that were not pathological. Attention was drawn by the few acute myocardial infarctions found.

Keywords
Electrocardiography, arrythmias, heart blocks, conduction disorders

■ INTRODUCTION

The electrocardiogram (ECG) is a linear record of the electrical activity of the heart (depolarization and repolarization of the heart muscle). This non-invasive technique had its origins in the first decade of 1900, created by physicist A. Einthoven. The ECG is the fundamental diagnostic technique for the study of cardiac arrhythmias, conduction disorders and pre-excitation syndrome. It is also useful for diagnosis and assessment of myocardial ischemia, especially acute myocardial infarction.

Its value remains unquestioned, after more than a century of notable diagnostic inventions in the specialty, due to its non-invasive, easy-to-perform, low-cost features, and the information it provides in the hands of experts.
Because ischemic heart disease is one of the leading causes of death worldwide(1), it is unthinkable to have an Emergency Department that does not use this diagnostic device.

The Emergency Department of the Karl Heusner Memorial Hospital (KHMH), a national reference hospital, in Belize City receives a large number of patients who, owing to their symptoms and the presence of coronary risk factors, require the use of this diagnostic means very frequently, which motivated the conduction of this study.

The aim was to assess the use given to the electrocardiographic study in the emergency department of the KHMH and more specifically to correlate the reports that the machine issues automatically with the criteria of a

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cardiologist; to classify the traces as normal and with changes (pathological or not) and to define the electrocardiographic changes present. By recognizing the most frequent cardiac emergencies using ECG, their treatment strategy can be improved.

■ MATERIAL AND METHOD

A retrospective study was conducted on 557 ECGs performed in the Emergency Department of the KHMH during 90 days. Different variables were analyzed, such as: age and sex of the patients, normal traces and with changes, correlation of the machine-specialist reports, and types of electrocardiographic abnormalities These data were compared for all the patients who showed up for different reasons (6,272). All these data were tabulated in Excel, to make their subsequent analysis easier.

■ RESULTS AND DISCUSSION

The following table was made including all attendees to the

Table 1. Age and sex distribution of the Emergency Department attendees

Age groups	Male	Female	Total
<1	117	88	205
1–4	239	265	504
5–9	330	197	527
10–14	229	169	398
15–19	217	335	552
20–24	274	334	608
25–29	262	329	591
30–34	223	263	486
35–39	207	248	455
40–44	169	237	406
45–49	182	173	355
50–54	123	165	288
55–59	118	120	238
60–64	85	74	159
≥65	244	256	500
Total	**3019**	**3253**	**6272**

Fuente: Registro personal de pacientes embarazadas del médico

Emergency Department Karl Heusner Memorial Hospital. The daily average of patients who attended the emergency department for various causes was 68, 6,272 in all. Of these, 557 had an ECG as diagnostic tool in accordance with their clinical picture (mainly chest pain and respiratory distress), which represented 8.9% (299 female, 53.7% and 258, male, 46.3%) (Table 1).

For the 577 ECGs done, taking into account that the equipment used (Burdick Eli 250c) provides a descriptive-diagnostic report of the traces made, the assessment of report correlation between machine and expert (specialist) was that 464 traces matched (83.3%) and 93 (16.7%) did not.

ECGs were separated into normal, which were 283 (50.8%), and with changes (pathological or not), 274 (49.6%).

The ECGs with changes were separated into four groups: arrhythmias (Table 2), conduction disorders (Table 3), electrical changes that could suggest myocardial ischemia (Table 4), and chamber enlargement (Table 5). A small

Table 2. Arrhythmias: 125 (22.6%)

Types of arrythmias	No.	%
Sinus tachycardia	52	41.6
Atrial fibrillation	24	19.2
Sinus bradycardia	17	13.5
Premature supraventricular contractions	8	6.4
Premature ventricular contractions	6	4.8
Premature pre-excitation syndrome	6	4.8
Supraventricular tachycardia	4	3.2
Sinus respiratory arrythmia	3	2.4
Atrial flutter	3	2.4
juntional tachycardia	2	1.6
Premature atrial contractions	2	1.6

group of patients with other diagnoses (without statistical significance) were included to complete the total. Arrhythmias were present in 125 traces for 22.6%, with sinus tachycardia as the most common arrhythmia (41.6%), but this, in itself, does not always reflect a purely cardiac disorder, since it is a sympathetic response related to various psychosomatic conditions. Sinus bradycardia, which also appears in multiple conditions and frequently as a vagal response, was in the third place. Thus, it is possible to consider atrial fibrillation (AF), present in 19.2% of the patients, as the main arrhythmia of cardiac origin recorded. This agrees with reports of similar studies carried out in other latitudes(2,3) that show that this arrhythmia is the most frequent due to two fundamental factors: high incidence of high blood pressure (HBP) and higher life expectancy. The former causes cardiac structural changes in the left chambers, especially in the atrium, and senility, since it is associated with ischemic disorders, one of the non-modifiable risk factors. Extrasystoles or, more correctly said, premature contractions, both supraventricular and ventricular, although dangerous, depending on the cause that originates them, as well as their frequency and characteristics of appearance, could also be a neuro-vegetative response to stress. In the group

with lower incidence that follows, all have atrial origin, as can be observed. Apart from some of them being normal,

Table 3. Conduction disorders: 77 (13.8%)

Types	No.	%
Left deviation of the electrical axis >-10^0	23	29.9
Right bundle branch block (RBBB)	13	16.9
Long P-R interval	8	10.4
Left bundle branch block (LBBB)	7	9.1
RBBB with left anterior hemiblock	5	6.5
Delta wave	5	6.5
Left anterior hemiblock	4	5.2
Third degree A-V block	3	3.9
Second degree A-V block	1	1.3
Early repolarization	1	1.3
Right deviation of the electrical axis >+120^0	1	1.3
Intraventricular conduction abnormalities	1	1.3
Long P-R with left anterior hemiblock	1	1.3
Short P-R interval	1	1.3
Left posterior hemiblock	1	1.3

e.g. sinus respiratory arrhythmia, and others, multifactorial, generally they do not affect cardiac output (volume per minute).

Both intra-ventricular and atrio-ventricular conduction disorders (A-V) were present in 77 EGCs accounting for 13.8% of all patients.

A greater than -10^0 deviation of the electrical axis to the left is considered an abnormality that could be caused by several factors, among them: the increase in size of the left chambers, which is due to an enlarged muscle that generates more powerful electric vectors, and also to intrinsic disorders of the conduction system caused by ischemia, sclerosis, medications, inflammation, etc. In this study, its position as the first cause (29.9%) of conduction disorders is supposedly due to the high incidence of HBP, specifically in the African-American population predominant in this region. It has repercussion in remodeling the heart by producing left chamber hypertrophy and imbalance of the myocardial supply-demand of oxygen (4).

Right branch bundle block (RBBB) present in 16.9% of patients, does not have the connotation of other intra-ventricular conduction disorders, because, in addition to being a normal pattern in some people, it is more related to conditions that enlarge the right chambers affecting their conduction system, which in turn causes hypoxia, generally occurring as a complication of chronic pulmonary diseases, among these, chronic obstructive pulmonary disease (COPD).

First-degree atrio-ventricular block, also called prolonged PR segment, detected in 10.4% of the cases, has different causes, the main ones being ischemia, associated with coronary-sclerosis; drugs, mainly due to the use of digitalis, and acute inflammation in infectious processes. In these cases, none had inflammatory origin.

Table 4. Electrical changes suggestive of myocardial ischemia: 27 (5.0%)

Types	No.	%
Changes in the ST-T segment with negative T wave anterior wall (8) inferior wall (3) lateral wall (1)	12	42.9
Nonspecific changes in the S-T segment	10	35.7
Past myocardial infarction inferior region (2) septal region (1)	3	10.7
Acute myocardial infarct with elevated ST-T (STEMI) (2)	2	7.1

Left bundle branch block (LBBB), which generally has a pathological cause, and is mainly associated with ischemic heart disease, was recorded in 9.1% of patients, followed by hemi-blocks and different degrees of AV blockages that were barely present when compared to other studies.(5,6) Electrocardiographic changes suggestive of ischemic etiology were only 5%; while in other studies they are usually the most frequent cause of morbidity and mortality in emergency services.(7,8,9) This is even more surprising due to the amount of risk factors in this population, such as: inadequate dietary habits, due to high consumption of "junk" food, in which carbohydrates, sugars and fats predominate; overweight and obesity, as well as diabetes mellitus and hypertension, all as part of the metabolic syndrome, and the sedentary lifestyle of many people. In the 3-month study, only two acute myocardial infarctions (AMI) were diagnosed and admitted, both with elevated ST-T (STEMI) and in the septal region. The possibility that patients do not reach the KHMH emergency service due to death or prefer to be admitted to private clinics is not an explanation for its low incidence, since this is at odds with the aforementioned risk factors in the population, and because most of the population lacks economic resources, which compels them to resort to the cheaper state services.

The alterations of the ST-T segment with negative T wave

expression of ischemia and/or left ventricular systolic overload were the most frequent changes in this section in 42.9% of the patients. They could correspond to coronary obstructive processes due to atheromatous plaques, as well as to oxygen supply imbalance due to hypertrophy and work overload in hypertensive patients. Past myocardial infarcts detected were also very scarce (10.7%). Nonspecific

Table 5. Chamber enlargement: 62 (11.1%

Types	No.	%
Left ventricle	36	58.1
Left auricle	11	17.4
Left auricle and ventricle	9	14.5
Right auricle	2	3.2
Right ventricle	2	3.2
Right auricle y ventricle	2	3.2

alterations of the ST-T segment in the second place in this group (35.7%), as their name describes, may be due to dissimilar causes that only complement the diagnostic suspicion, according to the clinical picture and other investigations.
Other changes that appeared in 62 traces and constituted 11.1% were the enlargement of cardiac chambers, and as expected, it was found in 90% of the patients–if enlargements of the left chambers were separately added (atrium 17.4%, ventricle 58.1% and both 14.5%). This is partly explained by the high incidence of hypertension in the population, as well as cardiomyopathies both hypertrophic and dilated. The latter often have alcoholic etiology, although they could also be due to sequelae of infectious myocarditis that is very common in tropical countries (viral, streptococcal, Chagas disease, etc.).

The remaining ECG findings were 8 and involved:
- Micro-voltage: 7
- Cardiac malposition: 1
These other findings were rare, representing only 1.4% and they included micro-voltage that was mostly due to COPD and one patient with dextrocardia as part of a known congenital heart disease.

As additional and interesting data, no ECGs were performed on newborns or infants in the hospital and only on isolated cases of children under 5 years of age.

Conclusions
1. Of all those attending the emergency service of KHMH, the daily average of ECGs performed was 8.9%. Of these 53.7% were female, and 46.3%, male. The indication was usually related to symptoms and/or signs interpreted as cardiovascular by the nursing staff, who, in most cases carry it out, following protocol.
2. Slightly more than half of the ECGs performed (50.8%) were normal.
3. The machine-expert report only matched in 83.3%.
4. Arrhythmias were the most frequent alteration in ECGs with changes (22.6%), while among these, sinus tachycardia showed the greatest presence. However, the only arrhythmia with heart disease origin was atrial fibrillation with 19.2%. It was followed by conduction disorders, of which 13.8% had deviation of the electrical axis to the left greater than -10º, the most frequent one.
5. That electrocardiographic signs of ischemic heart disease appeared in only 5% caught our attention. And there were only two acute myocardial infarctions diagnosed and admitted in the 90 days of the study.
6. Regarding the changes appearing in the ECG due to the enlargement of cardiac chambers, 90% included the left ones.

Recommendations
A. To make the most of the diagnostic advantages provided by an adequate performance of electrocardiographic studies, the following should be done, if the health authorities of the KHMH deem it appropriate:
• Electrocardiography courses for all the staff involved in ECG performance, depending on their role (doctors, nurses and technicians)
• Performance of electrocardiography in all pediatric ages (newborns to adolescents) should be emphasized, as specialized cardio-pediatric care is already available in KHMH.
• Taking into account the findings in the study of ECGs with changes (pathological or not), following the existent protocols is recommended for their adequate care.

B. The medical staff is advised to abstain from relying exclusively on the diagnostic report provided by the machine, since in this study 16.7% of these were wrong.

Revisión de los electrocardiogramas realizados en el Departamento de Emergencias del Karl Heusner Memorial Hospital

Resumen

Fundamentación El electrocardiograma (ECG) es una técnica no invasiva que no ha podido ser sustituida por la información que brinda.
Objetivo: *Correlacionar los informes automáticos que brinda el equipo con el criterio del cardiólogo, clasificándolos en normales y con cambios, definiendo estos últimos. Se puede mejorar la estrategia de tratamiento por el reconocimiento de las urgencias cardiacas utilizando el ECG.*
Material y método: *Se realizó un estudio retrospectivo de 557 ECG consecutivos realizados en el Departamento de Emergencias del Hospital Karl Heusner Memorial Hospital (KHMH) durante 90 días. Se analizaron diferentes variables como edad, sexo, trazos normales y con cambios, correlación máquina-especialista de los informes, y tipos de anomalías electrocardiográficas.*
Resultados: *Se les hizo ECG al 8,9% de los asistentes, para un promedio de 6,2 estudios diarios, de los cuales el 50,8% fueron*

normales según la valoración del experto y se observaron cambios en el 49,2%. Hubo una correspondencia máquina-experto en el 83,3% de los estudios realizados. Entre los que mostraron cambios se encontraron arritmias en el 22,6%, la más frecuente fue la taquicardia sinusal (41,6 %); se detectaron trastornos de conducción en un 13,8% predominando el bloqueo de rama izquierda (16,9%); un 11,1% mostro crecimiento de cavidades, y un 5,0%, cambios isquémicos.

There was a machine-specialist agreement in 83.3% of the studies done. In those with changes, 22.6% were arrythmias with sinus tachycardia (41.6%)

***Conclusiones:** La correlación máquina-especialista coincidió un 83,3%. Más de la mitad de los ECG fueron normales al sumarle los trazos con cambios que no eran patológicos. Llama la atención los pocos infartos agudos de miocardio encontrados.*

Palabras clave

Electrocardiografía, arritmias, bloqueos cardiacos, trastornos de la conducción

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Diet drinks may be associated with strokes among post-menopausal women.

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Drinking multiple diet drinks daily was associated among post-menopausal women with an increase in the risk of having a stroke caused by a blocked artery, especially small arteries according to research published in Stroke, a journal of the American Heart Association.

In a large observational study, women who reported drinking more than one diet soda or other artificially sweetened drink a day had a higher risk of strokes caused by a blood clot. This is one of the first studies to look at the association between drinking artificially sweetened beverages and the risk of specific types of stroke in a large (81,714 participants in the Women's Health Initiative study), racially diverse group of post-menopausal women. While this study identifies an association between diet drinks and stroke, it does not prove cause and effect because it was an observational study based on self-reported information about diet drink consumption. Compared with women who consumed diet drinks less than once a week or not at all, women who consumed two or more artificially sweetened beverages per day were: 23% more likely to have a stroke; 31% more likely to have a clot-caused (ischemic) stroke; 29% more likely to develop heart disease (fatal or non-fatal heart attack); and 16% more likely to die from any cause.

Certain women had higher risk. Heavy intake of diet drinks, defined as two or more times daily, more than doubled stroke risk in: women without previous heart disease or diabetes, who were 2.44 times as likely to have a common type of stroke caused by blockage of one of the very small arteries within the brain; obese women without previous heart disease or diabetes, who were 2.03 times as likely to have a clot-caused stroke; and African-American women without previous heart disease or diabetes, who were 3.93 times as likely to have a clot-caused stroke. Thus the association between diet drinks and stroke risk was stronger in obese women and in African-American women.

People, especially those who are overweight or obese, drink low-calorie sweetened drinks to cut calories in their diet. This research and other observational studies have shown that artificially sweetened beverages may not be harmless and high consumption is associated with a higher risk of stroke and heart disease, said Mossavar-Rahmani.

The results were obtained after adjusting for various stroke risk factors such as age, high blood pressure, and smoking. These results may not be generalized to men or younger women. The American Heart Association found inadequate scientific research to conclude that low-calorie sweetened beverages do, or do not, alter risk factors for heart disease and stroke in young children, teens or adults. The study is also limited by having only the women's self-report of diet drink intake and not what types of artificially sweetened beverages.

The American Heart Association recognizes diet drinks may help replace high calorie, sugary beverages, but recommends water (plain, carbonated and unsweetened flavored) as the best choice for a no calorie drink. Limiting prolonged use of diet drinks, given their lack of nutritional value, may be prudent.

Journal Reference: Mossavar-Rahmani Y, Kamensky V, Manson JE, Silver B, Rapp SR, Haring B, et al. Artificially Sweetened Beverages and Stroke, Coronary Heart Disease, and All-Cause Mortality in the Women's Health Initiative. Stroke, 2019; DOI: 10.1161/STROKEAHA.118.023100