

**ELECTROPHYSIOLOGY STUDIES ON THE HUMAN
CARDIOVASCULAR SYSTEM**

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ABSTRACT

The cardiovascular or circulatory system is a vital part of the human body, both by its structure and by the functions it performs.

Through the development of electrophysiology, processes and medical analysis equipment, the EKG technique has become the main method of analysis of this organ system in order to prevent and detect cardiovascular diseases.

In addition to EKG, other methods of medical analysis such as phonocardiography, vectocardiography, medical imaging, catheterization, have the role of helping to make the diagnosis that includes cardiovascular disease. The frequency of cardiovascular diseases is quite high globally, and the importance of their discovery and treatment is necessary, their lack leading to the death of the patient.

INTRODUCTION

The cardiovascular system consists of an organ complex whose main functions are the transport of oxygen and nutrients to the tissues and the transport of carbon dioxide and metabolites from the tissues to the elimination pathways (Cioroiu 2006). At the same time, the cardiovascular system also participates in regulating body temperature, distributing hormones and immune system cells (Cornilă et al. 2011).

The development and evolution of the cardiovascular system were closely correlated with the differentiation and development of the digestive, respiratory and excretory systems (Pop & Sas 2005).

Cardiovascular disease is currently the leading cause of death worldwide. Before 1900, mortality was mainly caused by infectious diseases and malnutrition, and cardiovascular disease was responsible for less than 10% of all deaths. At present, cardiovascular disease causes about 30% of all deaths worldwide, reaching almost 40% in developed countries and about 28% in undeveloped and developing countries (Loscalzo et al. 2013).

Diseases of the cardiovascular system can be grouped into endocarditis, valvular disease, pericardial disease, heart disease, conduction and rhythm disorders, coronary artery disease, heart failure, pulmonary cord, hypertension, shock, syncope and fainting, sudden death, atherosclerosis, arterial aneurysm,

functional diseases of the peripheral arteries, diseases of the veins (Lungu et al. 2020).

The heart is made up of three types of cells: pacemaker cells (the source of electricity for the heart in normal condition), conducting cells of the electrical impulse (the main network for the heart) myocardial cells (the contractile system of the heart) (Thaler 2018). Different heart cells serve different and highly specialized functions, but they are all electrically active (Boron & Boulpaep 2018).

The objective examination in cardiovascular diseases includes the general inspection of the heart patient and the current objective examination of the cardiovascular system. Objective examination is practiced by known physical methods: inspection, palpation, percussion and listening (Cozlea et al. 2015).

The electrophysiological study is a minimally invasive procedure with both diagnostic and therapeutic character, having an important role in the evaluation and treatment of rhythm disorders. All the different waves we see on an EKG are manifestations of two cardiac processes: depolarization and repolarization (Thaler 2018).

Electrocardiography is the technique of investigating cardiac electrical activity over time (Simu 2002), and the electrocardiogram (EKG) is the graphical representation of the electrical activity of the heart performed using the electrocardiograph (Aramă 2007). In electrocardiography, each pair of two electrodes, one negative and one positive, applied at certain points on the body forms a so-called derivation. Usually, 12 leads are used : 3 standard (bipolar) leads, 3 unipolar limb leads and 6 precordial leads (Alecu 2008).

Other medical tests of the cardiovascular system can be phonocardiography (technique of measuring and representing in time the acoustic effects of cardiac mechanical activity), vectocardiography (technique of spatial representation of the geometric place of the peak of the instantaneous cardiac vector, during a cycle, geometric place called a spatial cardiogram) (Simu 2002) and catheterization, which involves inserting tubes (thin plastic tubes) into the vessels to explore blood pressure, flow rate and other parameters (Cinteză 2005).

MATERIAL AND METHODS

This paper is based on a retrospective statistical study that includes a group of patients in the record of the clinic in Vârtop, Dolj County and who went to the clinic between 30.03.2020-30.03.2021 for various diseases.

This study is based on field research, the medical history of the patients and data provided by local institutions. The study included a number of 1512 patients, men and women, of different ages. Two selections were made: the first for identification of individuals with cardiovascular disease, which numbered 188 out of the total of 1512, and the second, made randomly, reducing the number of the reference sample to 100 individuals.

The individuals in the studied group were divided according to gender (male and female), age group (0-20 years, 21-40 years, 41-60 years, 61-80 years and 81+ years), but also depending on the diagnosis (entered in the analysis bulletin of each patient).

Through the statistical processing of the results from the analysis bulletins, a database was created which was used to represent them graphically and tabularly to interpret and discuss the results, as well as draw conclusions by reading them.

RESULTS AND DISCUSSIONS

An analysis of the distribution of patients with cardiovascular disease revealed an unbalanced impairment, out of the 188 patients with cardiovascular disease 53 of them were men, representing a percentage of 28,2%, and the rest of 135 were women, representing a percentage of 71,8%, much higher than that of men (Table 1, Figure 1).

Subsequently, a randomized selection was performed reducing the number of patients to 100 individuals who were divided into 5 age groups: the interval 0-20 years (with 0 patients), the interval 21-40 years (with 7 patients, of which one man and 6 women), 41-60 years (with 29 patients, 14 men and 15 women), 61-80 years (with 58 patients, 27 men and 31 women) and over 81 years (with 6 patients, 4 men and 2 women) (Table 2, Figure 2).

The heart rate in a normal adult is about 60-100 bpm. A heart rate above 100 bpm or below 60 bpm is considered abnormal. The heart rate lower than 60 bpm is called bradycardia, and the highest 100 bpm is called tachycardia. (Shade 2015).

The results of our study confirm the data from the specialty literature.

Regarding the dynamics of the heart rate in the 100 patients, there are three categories of diagnosis: bradycardia (12%), found in 6 men and 6 women, normal diagnosis (75%), in 32 men and 43 women and tachycardia (13 %), represented by a number of 8 men and 5 women (Table 3, Figure 3).

Regarding the heart rate, it is regular in most patients (94%) - 43 men and 51 women, a slightly irregular rhythm (1%), is found in only one woman, not being found in men, and the last category, represented by patients with an irregular rhythm has a percentage of 5%, 3 men and 2 women (Table 4, Figure 4).

The morphological aspect of the P and T waves, of the QRS wave complex and of the ST-T, PQ and PR wave intervals, is different from the normal one in a total of 14% of the sample of 100 patients, as follows: P wave and the T wave in one man and one woman, the QRS complex in 3 men and one woman, the ST-T interval is abnormal in 2 men and 3 women, the modified PQ interval register 0 men and one woman, and the PR shows no changes in this sample. The number of patients without changes in electrocardiographic waves is 39 (39%) men and 47 (47%) women (Table 5, Figure 5).

Table 1

Distribution of patients with cardiovascular disease by gender

Male	Female	Total
53 (28%)	135 (72%)	188 (100%)

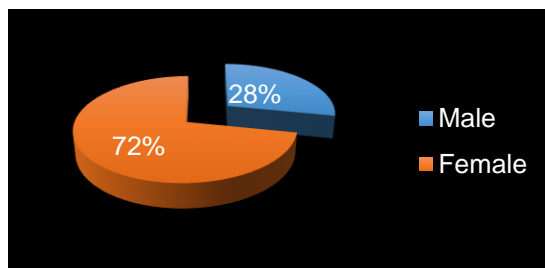


Figure 1. Distribution of patients with cardiovascular disease by gender

Table 2

Distribution of patients with cardiovascular disease by sex and age group

Age group	Number of patients	Male	Female
0-20 years	0 (0%)	0 (0%)	0 (0%)
21-40 years	7 (7%)	1 (1%)	6 (6%)
41-60 years	29 (29%)	14 (14%)	15 (15%)
61-80 years	58 (58%)	27 (27%)	31 (31%)
Over 80 years	6 (6%)	4 (4%)	2 (2%)
Total	100 (100%)	46 (46%)	54 (54%)

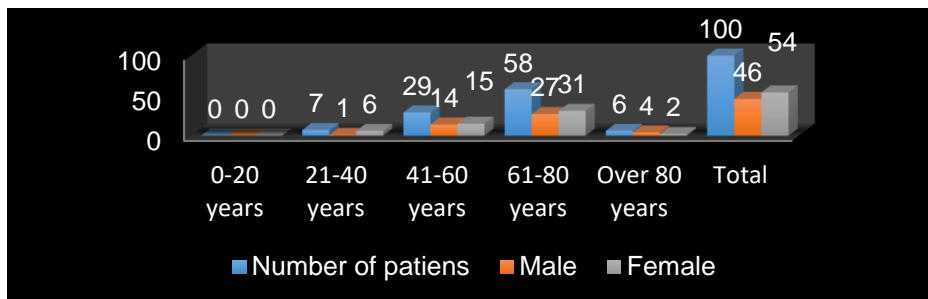


Figure 2. Distribution of patients with cardiovascular disease by sex and age group

Table 3

Heart rate dynamics according to diagnosis and sex of patients

	< 60 bpm Bradycardia	60- 100 bpm Normal	>100 bpm Tahycardia
Male	6 (6%)	32 (32%)	8 (8%)
Female	6 (6%)	43 (43%)	5 (5%)
Total	12 (12%)	75 (75%)	13 (13%)

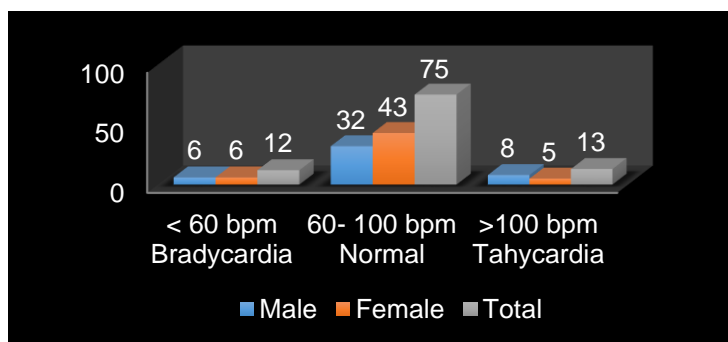


Figure 3. Heart rate dynamics according to diagnosis and sex of patients

Table 4

Heart rate dynamics according to patients' sex

	Regular rhythm	Slightly irregular rhythm	Irregular rhythm
Male	43 (43%)	0 (0%)	3 (3%)
Female	51 (51%)	1 (1%)	2 (2%)
Total	94 (94%)	1 (1%)	5 (5%)

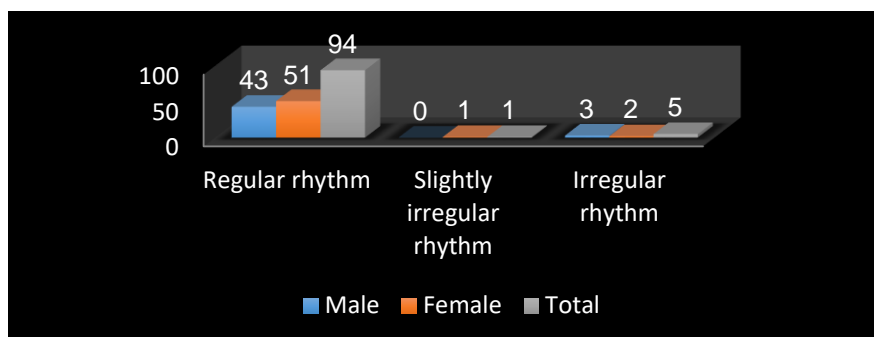


Figure 4. Heart rate dynamics according to patients' sex

Table 5

Modified electrocardiographic wave dynamics

	P wave	T wave	QRS complex	ST-T interval	P-Q interval	PR interval	Without abnormal waves
Male	1 (1%)	1 (1%)	3 (3%)	2 (2%)	0 (0%)	0 (0%)	39 (39%)
Female	1 (1%)	1 (1%)	1 (1%)	3 (3%)	1 (1%)	0 (0%)	47 (47%)
Total	2 (2%)	2 (2%)	4 (4%)	5 (5%)	1 (1%)	0 (0%)	86 (86%)

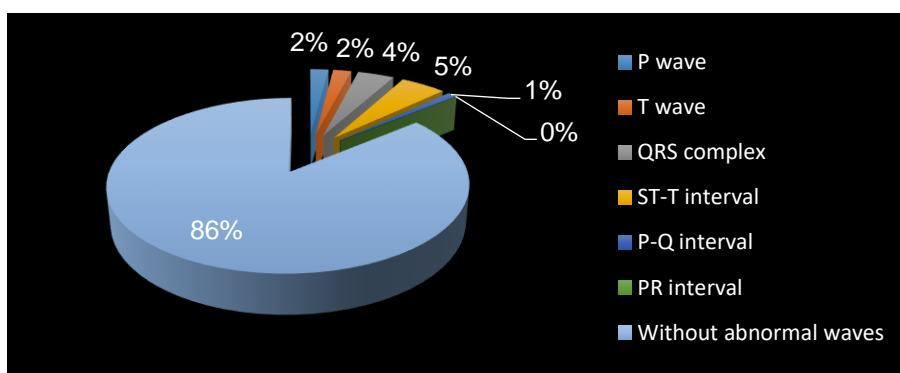


Figure 5. Modified electrocardiographic wave dynamics

The results of our study confirm the data from the literature.

One of the main aspects is that the number of affected women is much higher than that of men, proving that the risk of death from the acute coronary syndrome or heart attack is higher in women than in men (<http://www.descopera.ro/stiinta/7951794-barbatii-si-femeile-inegali-si-n-fata-bolii>).

CONCLUSIONS

Analyzing the distribution by age groups and gender, it can be seen that the largest number of individuals suffering from cardiovascular disease is found in the age range 60-80 years, which shows that with age the predisposition to cardiovascular disease the human body grows.

Regarding the distribution by gender and heart rate, a high percentage has frequency values within normal limits, but bradycardic individuals are in a percentage almost equal to tachycardic individuals. The very high percentage of individuals with normal frequencies demonstrates the effectiveness of the medication recommended by the specialist. The heart rate is regular in most patients, the slightly irregular and irregular being in very small percentages.

Wave changes are more common in the ST - T range and QRS complex and can be caused by factors such as cardiac hypertrophy, obesity, hyperthyroidism, pleurisy, ventricular preexcitation, branch block, intraventricular conduction disorders, absent ventricular conduction, etc. (Shade 2015).

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