Міжнародний Центр Наукових Досліджень

International Center for Scientific Research

Международный Центр Научных Исследований

Матеріали Міжнародної науково-практичної конференції

«АКТУАЛЬНІ ПИТАННЯ СУЧАСНОЇ НАУКИ»

м. Київ, 30-31 травня 2015 року

Материалы Международной научно-практической конференции

«АКТУАЛЬНЫЕ ВОПРОСЫ СОВРЕМЕННОЙ НАУКИ»

г. Киев, 30-31 мая 2015 года

International scientific conference

"ACTUAL PROBLEMS OF MODERN SCIENCE"

Kiev, 30-31 May 2015

Київ – 2015

МЕДИЧНІ НАУКИ

L.S. Fainzilberg, A.S. Pozdniakova

STUDY OF INTRAINDIVIDUAL ECG VARIABILITY OF HEALTH HUMAN USING PERSONALIZED DIAGNOSTICS

In traditional medicine, diagnostic decisions based on the concept of medical standards, which are understood as a reference intervals of physiological parameters derived from a representative sample of healthy people.

However, clinical experience shows that course of the disease of many people goes beyond of generally accepted standards. In this regard, scientists are actively discussing the concept of so-called personalized medicine, able to improve the quality of diagnosis and treatment. The basic principle of personalized medicine is to treat the patient, but not the disease leaning on the individual characteristics of the organism.

This requires contemporary diagnostic tools that can detect the risk of this or that disease in a particular patient in the early stages and to choose the optimal medical tactics for him.

The report proposes a general scheme for constructing of personalized diagnostic decisions and demonstrates the possibility of practical realization of such a scheme in the evaluation of cardiac activity, in view intraindividual electrocardiogram (ECG) features.

Us assume that on the basis of population studies of representative group of healthy people in the M-dimensional space of diagnostic signs $x_1,\cdots,x_M$ is allocated population "norm" as the area Ω_0 with center C_0. We also assume that there is a possibility for large enough period of time to carry out multiple performance measurement $x_1,\cdots,x_M$ for individual patient. As a result of such measurements in the same space is built a «personalized» area Ω_i with the center C_i, on which are distributed values of this patient.

Fig.1 shows four examples for the mutual arrangement of the regions Ω_0 and Ω_i in the space of signs:

• $\Omega_i \subset \Omega_0$, area Ω_i is fully included in the reference area Ω_0 of population surveys (Fig. 1a);

• $\Omega_i \cap \Omega_0 \neq \varnothing\, \Omega_i / (\Omega_i \cap \Omega_0) \neq \varnothing$, area Ω_i only partially included in the reference area Ω_0, and $C_i \in \Omega_0$ (Fig. 1b);

• $(\Omega_i \cap \Omega_0) \neq \varnothing, \Omega_i / (\Omega_i \cap \Omega_0) \neq \varnothing$, area Ω_i partially included in the reference area Ω_0, but $C_i \notin \Omega_0$ (Fig. 1c);

• $(\Omega_i \cap \Omega_0) \neq \varnothing$, area Ω_i beyond the reference area Ω_0 of population surveys (Fig. 1d).

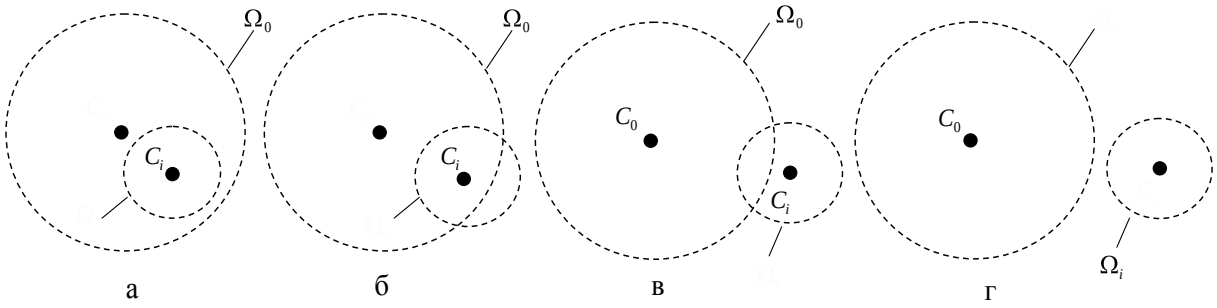

Fig. 1. Population Ω_0 and individual Ω_i areas of measurements with centers C_0 and C_i

Then, the first situation (Fig. 1, a) the patient can be considered like a healthy, in the second situation (Fig. 1b) - relatively healthy despite the fact that the individual measurements are not consistent with the reference values. In the third situation (Fig. 1c) and especially in the fourth (Fig. 1d), we have no choice, because we should to relate them to the risk patient, requiring in-depth additional examination.

It is clear that the results of each new measurement indicators of any patient can clarify its personalized rate Ω_i. Then personalized area Ω_i of parameters of the patient can be divided into separate zones of personalized solutions (Fig. 2).

• I - personal "norm";

• II - moderate deviations from the personal "norm";

• III - expressed deviations from the personal "norm".

Moreover, with the help of the distance r_i between the centers C_i and C_0, zones II and III should be divided into two sub regions: moderate and expressed worsening, when $r > r_i$, and moderate and expressed improvement, when $r < r_i$.

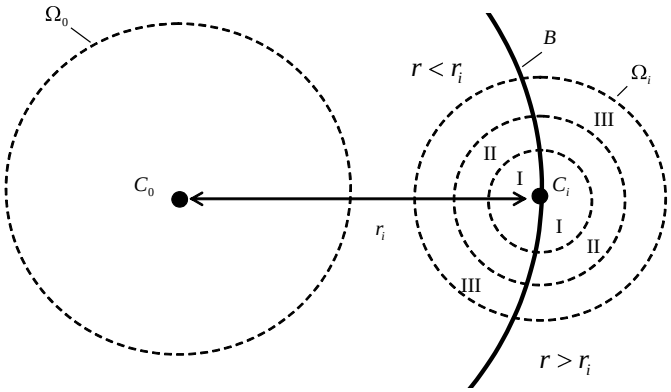

Fig. 2. Zones of personalized solutions

For practical implementation of the proposed scheme of personalized diagnostic of functional heart state were conducted research with the help of FAZAGRAF® [1] software and hardware complex. Were studied intraindividual ECG changes of the first standard lead, which were detected by using original sensor with finger electrodes (Fig. 3).

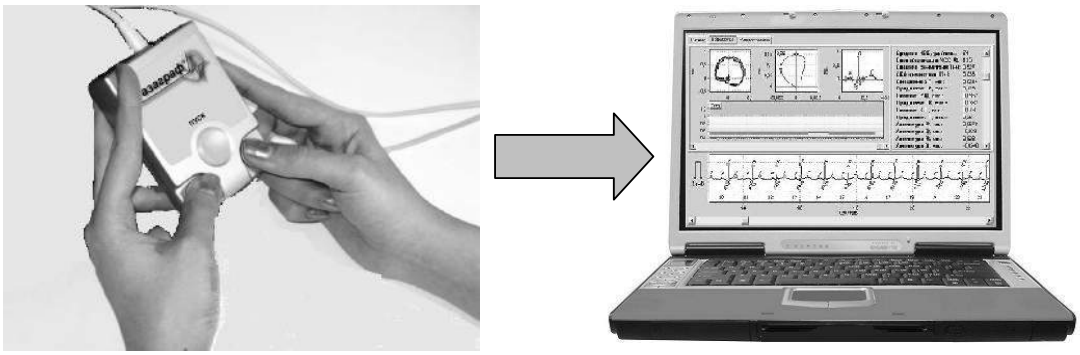

Fig. 3. FAZAGRAF® software and hardware complex

The computer program automatically determines the standard ECG parameters, including heart rate (HR), the intervals of PQ and QT, width and depth of the Q-wave, the length of the QRS complex, the amplitude of the T-wave, the original parameter β_T, which determines the symmetry of the T-wave in the phase space, also statistical and spectral parameters of heart rate variability (40 indicators).

During researches in the complex's database has been accumulated 3077 measurements of healthy people (population data) and measuring volunteer 4296

(intraindividual data). Based on these data, it was estimated the conditional distribution of parameters in groups (see example on fig. 4) and also built personalized diagnostic rule using the scheme described above.

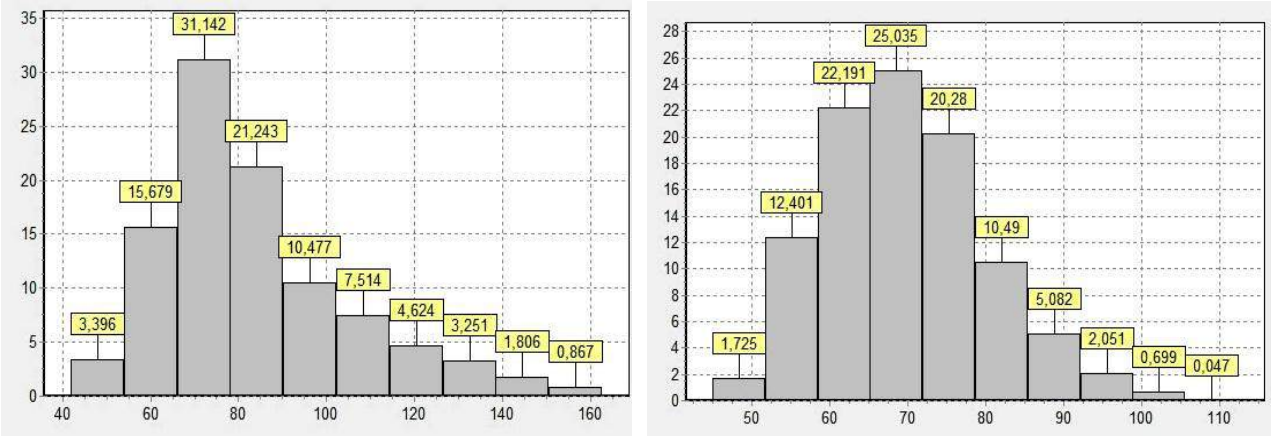

Fig. 4. The conditional distribution of HR in groups:
Left: population $HR = 69{,}7 \pm 10{,}4$; Right: intraindividual $HR = 83{,}5 \pm 21{,}9$

Literature

1. Personalized electrocardiograph FAZAGRAF®. – http://fazagraf.irtc.org.ua/

2. Fainzilberg L.S. Computer diagnostics of phase portrait of the electrocardiogram. - Kiev: Osvita Ukraini, 2013. – 191 P.

ПЕДАГОГІЧНІ НАУКИ

Войтко Валентина Володимирівна

Комунальний заклад

"Кіровоградський обласний інститут