SYNTHESIS OF DIAGNOSTIC RULES OF CONDITIONS OF VESSELS OF LEGS ON A FREQUENCY RANGE

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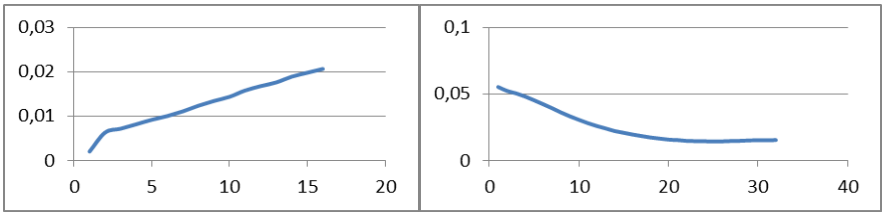
***Abstract**: In article the diagnostic possibilities of characteristics of a range of a signal of the photoplethysmogram, registered in the multichannel way, for classification of destructive conditions of legs are considered. The decisive rules allowing to diagnose a condition of venous blood circulation of legs by results of simultaneous registration of signals from phalanxes of fingers of the top and lower extremities are provided. Rules are synthesized by results of the prospecting analysis of clinically confirmed information for states: "is healthy", "critical condition", "a latent state", "a reversive state". Values of indicators of quality are given: diagnostic efficiency, sensitivity and specificity. The reached values of indicators are recorded in the range of 0,85±0,15*

Keywords: lower extremities, destructive states, photoplethysmogram, preventive diagnostics, decisive rules.

There is an urgent problem of improvement of medical care of the population due to high-quality preventive diagnosis of diseases of the lower extremities tied with violation of venous blood circulation and the general condition of cardiovascular system [1]. The solution is based also on achievements in the field of artificial intelligence on the basis of modern information and computer technologies now.

The photoplethysmogram and its characteristics received by application of a range of Fourier [2, 3] are applied to diagnostics and monitoring of destructive conditions of the lower extremities.

However, in clinical medicine repeated transformations of Fourier which classification opportunities of characteristics are proved for the analysis of conditions of technical objects now do not find due application yet. For example, in the figure the distinctions a rising in the course of loading having classification potential are shown.



A) To load B) after loading

Figure . - Double return transformation of Fourier of a signal of FPG

As a result of carrying out the prospecting analysis the following decisive rules for the automated system of support of decision-making are received (healthy and sick volunteers aged from 20 up to 70 years which vessels of the lower extremities were in clusters of states were investigated: "healthy", "latent", "reversive", "critical").

- *rule 1*: "If a variability of a phase of a range of the registered signal from toes: exceeds 40%, that condition of vessels is in critical condition and therapeutic influence is required; it is less than 25%, destructive changes are improbable; lies in an intermediate interval – reversive or latent states are possible";

- *rule 2:* "If logarithm of a mean square deviation of amplitudes of a range of a signal: more than 4 in the field of the frequencies limited to an interval of 20-30 f_0 and it will not be executed for other ranges, the patient corresponds to a cluster "healthy"; if less than 4 in all frequency ranges or more than 4 in the range of 1-4 f_0 (low frequencies), then "critical" corresponds to a cluster; if more than 4 in the range of 1-10 f_0, then – "reversive"; if more than 1 in the ranges of 1-4 f_0 or 3-17 f_0, then – "latent".

- *rule 3*: "If a mean square deviation of the relations of mean square deviations to estimates of population means of amplitudes of frequency ranges in the considered frequency ranges: less than 0,16, critical condition is observed; more than 0,36 – "healthy"; 0,2±0,04 – "latent"; 0,3±0,06 – "reversive".

- *rule 4*: "If coefficient of pair correlation between the registered signals on fingers of a hand and a leg: exceeds 0,32 – that condition of the patient corresponds to a cluster "healthy", less than 0,15 – "critical", [0.15; 0.26] – "latent"; [0.28; 0.31] - "reversive";

- *rule 5:* "If coefficient of pair correlation between amplitudes of ranges of signals of FPG of "hands" and "legs": more than 0,85 – that condition of vessels of the lower extremities is diagnosed as "latent" if less than 0,4 – as "critical", lies in the range [0.4; 0.65] – as "reversive", lies in the range [0.5; 0.85] – as "healthy".

The carried-out tests showed that diagnostic efficiency of application of rules made 0,85±0,15 that allows to draw a conclusion on prospects of introduction of the considered system and technology of work in clinical practice.

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