

METHOD OF AUTOMATIC DETERMINATION OF THE HEART'S ELECTRICAL AXIS

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Telemedicine has become widespread in connection with the health care system reform in Ukraine. The main goal of telemedicine is to provide highly qualified medical care not only to residents of large cities in which there is a developed network of medical institutions but also to residents of remote settlements by organizing access to the best regional doctors. In the pilot project "Telemedicine" which was launched in 2019 as part of the medical reform of Ukraine, there is planned to provide medical services in four nosologies: cardiovascular; endocrinological; respiratory diseases; dermatological. Thus, cardiology is one of the effective areas of telemedicine application. At the same time, in order to introduce telemedicine into cardiology, it is necessary to develop new and improve existing medical diagnostic systems which include the cardiological decision support systems (DSS) in addition to specialized equipment. One of such diagnostic complexes is the medical diagnostic complex "TREDEX" (manufactured by "Company TREDEX" LLC, Kharkiv) which includes the cardiological decision support systems "TREDEX telephone". The most common way to diagnose the heart and cardiovascular system conditions is morphological analysis of an electrocardiogram (ECG) with the following analysis of the amplitude-time parameters, as well as the shape of waves and complexes which are found.

The purpose of the study is to automate the calculation of the heart's electrical axis (the QRS axis) to improve the quality of morphological analysis of ECGs in cardiological decision support systems, which in turn reduces the likelihood of medical mistakes.

The study developed the method for automatic determination of the QRS axis based on the integral signal calculation for six standard ECG leads, which will improve the quality of morphological analysis of the ECGs in cardiological decision support systems and reduce the number of medical mistakes. The proposed method makes it possible to determine the QRS axis without the need to search and analyze QRS complexes which makes it possible to correctly calculate the QRS axis even for complex clinical cases. The authors have developed software for the module of automatic determination of the QRS axis in the Matlab language. To connect the developed module to the cardiological DSS "TREDEX telephone", the program was exported to DLL. In the work, the developed method was verified on real ECGs which were recorded using the 12-channel transtelephone digital electrocardiological complex "Telecard" and transcribed by cardiologists of the communal non-profit enterprise of the Kharkiv Regional Council "Center for Emergency Medical aid and disaster medicine". Comparison of the results of calculating the QRS axis according to the electrocardiogram by the doctor and automatically using the proposed method showed that in the overwhelming majority of cases the decisions made coincide. At the same time, cardiologists make mistakes, and errors are made during automatic calculation using the proposed method. The reasons for these mistakes and errors are explained in this study.