Computer decision support system for the stomach cancer diagnosis

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Abstract. The paper considers the creation of the computer knowledge base containing the data of histological, cytologic, and clinical researches. The system is focused on improvement of diagnostics quality of stomach cancer - one of the most frequent death causes among oncologic patients.

1. Relevance of research
The development of medical technologies results in augmentation of the volume of information which the doctor has to study. In this regard there arises a necessity of the application of program systems for the solution of various tasks, from simple ones to complex decision-making tasks related with treatment and diagnostics of patients state.

According to the International Agency for Research on Cancer (IARC) the stomach cancer takes the 4th place in the structure of the oncologic morbidity rate and the 2nd place in the structure of the oncologic mortality in the world. In absolute figures in 2008 these indicators amounted to 988 thousand of new cases of decease and 736 thousand cases of lethal outcomes. Data on the mortality from the stomach cancer in a number of countries are provided in the table 1. At present in Russia the stomach cancer takes one of leading places on morbidity rate and mortality.

Table 1. Mortality from the stomach cancer (on 100 thousand of population).

| Place | Country | Men Indicator | Women Country | Women Indicator |
|-------|---------|---------------|---------------|----------------|
| 1     | Russia  | 36.9          | Russia        | 15.3           |
| 2     | Kazakhstan | 33.1       | Kazakhstan     | 13.9           |
| 3     | Japan   | 30.2          | Japan         | 12.7           |
| 4     | China   | 26.9          | China         | 12.3           |
| 5     | USA     | 4.4           | USA           | 2.0            |
The forecast of the stomach cancer depends first of all on tumor detection stage and volume of the treatment realized. The general indicator of the five-year survival at the stomach cancer identification is about 15%, of the ten-year one is about 11% [1]. The survival statistics depending on a stage at the diagnosis "The stomach cancer" is given in the table 2.

| Stage | Five-year survival, % | Detection of cancer at this stage, % |
|-------|-----------------------|-------------------------------------|
| I     | 80                    | 1                                   |
| II    | 56                    | 6                                   |
| IIIa  | 38                    | 13                                  |
| IIIb  | 15                    |                                     |
| IV    | 5                     | 80                                  |

Identification of the stomach cancer at a late stage is caused by the following reasons [2]:
- 45-60% of cases – the untimely address of the patient to the doctor;
- 25-40% - an asymptomatic course of disease;
- 9-15% - statement of the erroneous diagnosis.

A rather high percent of erroneous diagnoses is related with the similarity of stomach cancer symptoms to the peptic ulcer, separate forms of gastritis, lymphoma.

It becomes obvious that the solution of diagnostic difficulties at the stomach cancer requires new diagnostic methods with application of knowledge bases and expert systems. These systems provide collecting, processing, storage and transfer of medical information in the field of the clinical oncology and act as medical decision support systems [3-7].

The objective of this work is the creation of the knowledge base for the decision support system at the stomach cancer diagnostics which summarize anamnesis data and diagnostic researches.

2. Expert systems at the diagnostics of the stomach cancer

One of the main directions of works in field of oncological diagnostics belongs to creation and development of expert systems. The expert system is understood as the hardware and software system accumulating experience and knowledge of highly skilled doctors (experts) and designed to provide advice to doctors in complex diagnostic cases.

Expert system is the computer system which use knowledges of one or several experts presented in some formal form and also logic of decision making by the expert person in difficult tasks. Expert systems are capable in a difficult situation (in case of lack of time, information or experience) to give qualified consultation (recommendation, the hint) helping the specialist to make reasoned decision. The decision support system acts as the expert system [4,5].

The main stage of development of decision support system was designing the knowledge base which data on patients with the diagnosis "Stomach cancer" are stored. The structure of this knowledge base is provided in the figure 1.
The developed system allows to collect the data of objective research (survey, palpation, percussion, listening), additional research methods (clinical laboratory methods, special methods (MRI, CT, ultrasonography, PET, radiological, radio isotope diagnostics), instrumental methods (gastroscopy, laparoscopy), morphological methods and subjective research methods (anamnesis of life, anamnesis of disease, complaints of patients)).

The system is realized in the programming language C++ with using of cross-platform developer tools of the application software Qt. The relational database under control of MySQL[11-12] is developed for the storage of researches data.

The developed system allows to integrate the data about patients by receiving of text, graphic and numerical information in the input. The system provides testing and training of doctors necessary for their preliminary- and post-training as well as reference medical information.
3. Conclusion
The program for stomach cancer diagnostics is created, it realizes the knowledge base summarizing the data of objective, additional and subjective researches at the diagnosis of the stomach cancer of stomach. The developed knowledge base is destined for use as the support system of diagnostic decisions. The user-friendly interface allows to use the program freely to doctors with basic computer skills. The program provides the question-answer dialog for the simplification of user’s work.

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