The Intelligent Support System for Remission in Patients with Psychiatric Disorders in Epilepsy

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Abstract – **In the paper is related a project of an Intelligent Support System development for research and treatment of epilepsy. The tasks of this study are: a) to prove on material of over 100 patients with remissions that epilepsy is curable; b) to classify these persons by remissions groups; e) to develop and implement an intelligent support system for research, diagnostics and treatment assistance in epilepsy, d) principles development and implementation for psychological and psychiatric assistance and for critical situations remedy with which epileptics patients face, inclusively with socio-psychological assistance service conditions and within psycho neurologic consulting rooms. At the moment are developed: an expert system for diagnosis of epileptic patients with psychiatric disorders, an electronic textbook in the area of epilepsy problems, a support system for development of treatment programs of epileptic patients.**

Index Terms — **artificial intelligence, epilepsy, expert systems, decision support systems.**

I. INTRODUCTION

The task of treatment of epileptic patients with psychological disorders became drastically a global problem. Many neurologist and psychiatrist doctors are more and more preoccupied with this problem and the obtained results became more important and precious. Recent statistical data shows an increase of up to 10.2 persons per 1000, while in developed countries from West Europe, US and Canada are related data of 2.4-7.2 persons per 1000. People with epilepsy need not only appropriate treatment, but the social-psychological support and they require mandatory society understanding and moral support. Every day, scientists and practitioners in the area of epileptology, make great efforts to find outstanding remedies involving experts from other areas with scope to solve an important task as treatment of epilepsy with psychological disorders.

The number of patients in Republic of Moldova with revealed epilepsy increases from year to year, even in conditions of massive migration, fact proved by increased number complains from population and in particular from young persons to neurologists and psychiatrist.

The epilepsy is a problem multidisciplinary. The success in epilepsy treatment requires collaboration of high qualification experts from different areas as: neurologists, psychiatrists, geneticists, pediatrician, mathematicians, immunologists, neurophysiologists, neuro-pharmacologists, artificial intelligence specialists.

Impressive discoveries from last years in the areas of genetics, immunology, neurophysiology, practical research and artificial intelligence encourage that in the near future the medicine will overcome the dogma of incurability of epilepsy.

II. THE SCIENTIFIC NOVELTY AND EXPECTED RESULTS

Based on a complex analysis on research material, methods of treatment for resistant types of epilepsy, development and implementation of intelligent support system for diagnosis and treatment of epilepsy will be attempt to develop for the first time in our republic an intelligent support system for treatment and diagnosis of epilepsy.

We propose a new project composed of *six stages*, which unifies the expertise in the area of medical science, physiology, decision support systems and artificial intelligence. Our research combines the development of: an expert system for diagnosis of epilepsy patients, a support system for doctor assistance during program process development for epilepsy patients treatment, selection and data results classification regarding patients with epilepsy remission, database development based on medical histories of epilepsy patients with remission, analysis of these data from database and retrieval of knowledge regarding the effect of remission of these data, expert system development to forecast the new patient with remission group with symptoms of epilepsy, developing a distance learning system of epilepsy and prophylaxis of this disease.

The first stage of the project is to develop *an expert system* for diagnosis of epilepsy patients. The system is planned to assist doctors from Moldova clinics and abroad. The system will provide a higher level of medical diagnosis from provinces and respectively, a smaller quantity of errors in diagnosis. The expert system is projected to be used in the training process in Medical Universities. It also could be used to support remote diagnosis process of patients with symptoms of epilepsy and to be used for population information on epilepsy and prophylaxis of this disease.

The second stage of the project is planed for development of a support system for doctor's assistance within the process of development of patient epilepsy treatment. The system will be developed following specialty classifiers.

The third stage of the project consists in data selection and systematization based on patients with remission of epilepsy,

database development regarding medical histories of epilepsy patients with remission. In present there are found 110 former epilepsy patients and brought with contribution of a new treatment (non-conventional) methodology into remission of the disease. Data regarding on medical reports of these group of patients will be prepared according to requirements of *Data Mining* technology for preparing data based of patients' peculiarities (age, social group, diagnosis, etc.).

The fourth stage of the project will consist of database knowledge retrieval. Knowledge will be collated into groups of patients according to diagnosis and degree of remission. Our experience of treating patients with epilepsy and bringing on remission status allows us to distinguish following classes of patients with remission:

a) *patients with therapeutic remission* – patient is maintained in this condition on a background of daily therapeutic treatment;

b) *patients with therapeutic remission with stable compensation* – to patient are not prescribed any drugs;

c) *patients with spontaneous remission* – after a short period of anti-epileptic drugs prescription (3-6 months);

d) after anti-epileptic drugs prescription (6-12 months);

e) *patients judged by differential diagnosis with other diseases* (early metabolic disorders, deficiency of Mg ions, Ca etc.);

f) *cured patients, with diverse long term remission and intermission*;

g) *patients, who eventually are diagnosed and then cured*.

The fifth stage of the project – development of an expert system for prognosis of a new patient with epilepsy symptoms within remission group.

The sixth stage of the project – development of a distance learning system on epilepsy and an information system of population regarding epilepsy and prophylaxis of this illness. As result of performed investigations we intend to promote and implement a series of original and differentiated programs of family and social rehabilitation, epilepsies prophylaxis through information and education, provisions and suggestions for epilepsy prophylaxis and treatment.

At the moment are developed:

- *an expert system for diagnosis of epilepsy patients with psychiatric disorders;*
- *epilepsy knowledge base;*
- *an electronic textbook in epilepsy;*
- *a support system for development of epilepsy treatment programs;*
- *other software components in the context of the project.*

III. THE EXPERT SYSTEM

The results of performed research will be translated into valuable applicative suggestions, which will explore the topic in all its biological, psychological and social aspects. Prognosis and prophylaxis recommendations, and curability of epilepsy under medical and psychological indicators, estimation of recovery methods and their reasoning for practical thinking in stationary conditions, in mental health centers and within family will facilitate the development of new organization forms of epilepsy patients recovery, given the particular pathology detected.

In the process of diagnosis setting may occur more choice, despite all medical data were collected. An expert system suggests a series of questions and provides the best clear conclusions that can be derived based on responses provided by the user (doctor). To facilitate the decision process of an accurate diagnosis, it was quickly developed an expert system for diagnostics. The expert system provides conclusions that are drawn based on responses provided by the system user (healthcare professional) to a series of questions proposed by the system. Development and implementation of expert system in medicine is a requirement of the time due to its use will help to increase the accuracy of making a diagnosis, reducing the time required set a diagnose and reduction of diagnostic errors. Exploiting an expert system is actually for Moldova and due insufficient number of specialists in epilepsy field in many rural health facilities. All the responsibility bears the family doctors who would welcome a "*diagnostics algorithm*" of expert level. It is expected to use the expert system developed for both diagnosis and treatment of patients with mental disorders, also in the process of health professionals training.

With the aim of developing an expert system in psychiatry [1-3] it was taken into account a particular group of diagnosed diseases of mental disorders. Thus, the diagnosis of diseases of the group mentioned above has some peculiarities; they are based on clinical investigations.Using expert system can be established nine groups of diagnoses mental graded from F00 to F09 in ICD-10 classification of mental and behavioral disorders [4]. Epilepsy expert system is equipped with a knowledge base. In the computer this base is stored in two forms: a) a version in Prolog - to diagnose epilepsy, and b) a version in HTML - to develop treatment programs for epilepsy patients with psychiatric disorders. Expert system can be used both as support to diagnosis of epilepsy patients with psychiatric disorders and in teaching.The expert system is developed in Prolog language and contains the following main components:

- *Knowledge Base for Diagnosis*, which contains specialty-specific facts and rules based on which is operated knowledge base for diagnosis with the aim to carry out reasoning to obtain solutions, recommendations or conclusions that are related to setting patient epilepsy diagnosis. The presentation model of knowledge is a *map*.

- *Dialog Interface* - allows dialogue with end users during the consultation sessions, and users access to base facts and knowledge;

- *Knowledge Acquisition Module* - provides to expert user querying types of the system with aim of obtaining solutions as well as methods of knowledge base modification (adding, removing or modifying cognitive units);

- *Explanatory Module* – have the role to explain the user, as well data available to the system, as reasoning process that is performed or solutions obtained within professional advice.

The presentation model of knowledge is a Map that reflects the link between disease and symptoms.

Developed expert system establishes mental disorders according to symptoms that patients have. It asks questions concerning 132 symptoms. The software result can be one of 24 different diagnoses.

Knowledge base for diagnosis keeps information regarding treatment rules of mental illness. The conclusion, obtained by inferential Engine of Expert System serves as a prerequisite for the next phase - development of treatment programs for epilepsy patients.

Due to this the expert system is equipped with two knowledge bases: first - to support the diagnosis, the second - to support development of treatment programs.

IV. ELECTRONIC TEXTBOOK IN EPILEPSY

Electronic textbook on epilepsy is a database for support of programs' development for treatment of patients with epilepsy. The electronic manual contains tables with information about the group diseases F00 to F09 (Fig. 1).

The first page is introductory and contains psychiatry symbolism placed on a graphic background. The end user accessing this page confirms the intention to browse the textbook by activating the button: "*Welcome*". Then the electronic manual switches to view the 2nd page. This page contains information on the textbook cover for mental illness. Clicking on cover book, it makes the transition to Contents of the book. All information relating mental illness is presented on separate pages. Here it is possible to click on any link from Contents, going to the page describing the requested theme. Can be used following options to browse the electronic textbook "*Next page*" (from first page to last), "*Previous page*" (from the current to the homepage). Browsing is carried out in accordance click the arrows on the right field (moving forward) or left (backward) of the electronic manual.

Fig. 1. Electronic Textbook

V. THE DECISION SUPPORT SYSTEM FOR DEVELOPMENT EPILEPSY TREATMENT PROGRAMS

The problem of treatment programs is a weak-structured problem and it may have several solutions. Therefore, for solving problem of issuing advices regarding treatment peculiarities was developed a decision support system. Database of support system for developing treatment programs is organized in pages (Fig. 2).

The tables contain information on diseases of the group F00 to F09 [4], including data about:
- Laboratory investigations;
- advices provided by specialty doctors;
- treatment schemas;
- daily dosage;
- costs.

On top of the table is the table of contents, which contains information on the groups of diseases. By clicking on the row of the table contents, it is accessed information about this group of diseases. Pressing the button labeled "*Return to top*", we return to contents of this book. The table *Treatment* can be accessed from the Contents page

of the electronic manual. The system can be used as well in medical practice, as for training of healthcare professionals. The strategies implemented within system are based on the knowledge of expert specialists in the area.

Fig. 2. A fragment of the Database „Treatment"

VI. CONCLUSION

In the paper was described a project of development of an intelligent support system within research and treatment area of epilepsy. The tasks of the research are: a) to prove based on material of over 100 patients with remissions that epilepsy is curable, b) to group these people by remissions groups, c) to develop and implement an intelligent support system for epilepsy research, diagnosis and treatment assistance, d) to develop and implement the principles of psychological, psychiatric and to remedy the critical situations with which face epileptics, including support services under the socio-psychological and psycho-neurological clinics. Currently are developed: an expert system for diagnosis of epilepsy patients with psychiatric disorders, an electronic textbook in the area of epilepsy, a support system for developing treatment programs for patients with epilepsy and other components in the context of research.

REFERENCES

[1] Butnaru M., Căpăţână Gh., Popov Al. Dezvoltarea sistemului de diagnosticare în medicină. În: Conferinţa Internaţională "Telecomunicaţii, Electronică şi Informatică" ICTEI 2010, ediţia a treia , Volumul II, Chişinău 20-23 mai, 2010, p.306-311.

[2] Carcea Iu., Butnaru M., Căpăţână Gh., Popov Al. Generator de sistem expert în medicină. În: Conferinţa Ştiinţifică "Dezvoltarea cercetării ştiinţifice, promovarea şi cultivarea creativităţii şi a inovării în procesul instruirii academice". 5 mai 2010. Rezumatele comunicărilor. Ştiinţe reale şi exacte. – Chişinău: CEP USM, 2010, p. 115-116.

[3] Moscalenco S., Butnaru M., Căpăţână Gh., Popov Al. Sistem suport de asistare a tratării pacienţilor. În: Conferinţa Ştiinţifică "Dezvoltarea cercetării ştiinţifice, promovarea şi cultivarea creativităţii şi a inovării în procesul instruirii academice". 5 mai 2010. Rezumatele comunicărilor. Ştiinţe reale şi exacte. – Chişinău: CEP USM, 2010, p. 129-130.

[4] The ICD-10 Classification of Mental and Behavioural Disorders. Clinical descriptions and diagnostic guidelines. Geneva, World Health Organization, 1993. – 263 p.