INTELLIGENT INFORMATION SYSTEM OF MONITORING, DIAGNOSIS AND PROGNOSIS OF DISEASES IN URGENT THERAPY USING CARBON MONOXIDE POISONING AS AN EXAMPLE

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Carbon monoxide poisoning is still one of the most widespread types of toxic affections. Carbon monoxide (CO, carbon oxide) is formed wherever exist conditions for in complete combustion of carbon containing substances. The principal cause of carbon monoxide formation is oxygen deficiency in the combustion zone when carbon monoxide is formed instead of non toxic carbon dioxide .The danger of carbon monoxide (CO) is increased because of the fact that CO has neither smell nor colour or taste and for this reason a person does not feel what happens to him during poisoning.

The mechanism of carbon monoxide effect on human organism is as follows: carbon monoxide which easily penetrates through lungs into blood, interacts with hemoglobin forming carboxyhemoglobin (HbCO) and blocks the transfer of oxygen to tissue cells which leads to hypoxia. Nervous system as the most sensitive to hypoxia becomes the most adversely affected by CO toxic action.

Acute and chronic carbon monoxide poisonings are distinguished. Under production conditions pollution of the atmospheric air by smalldoses is possible prolonged effect of which on human organism brings about chronic poisoning. Acute CO poisoning may manifest itself in mild, moderate, severe form. Carbon oxide produces hypotoxic, neurotoxic and hemotoxic effect. The symptoms are: prolonged comatose state, cramps, paralyses, brain edema, respiratory insufficiency, hypertonic syndrome, cardiac muscle affection, myocardial infaretion may develop.

The main syndromes which are observed in case of acute CO poisonings are respiration disturbance syndrome, cardiovascular affection syndrome, cerebral circulation disturbance syndrome, cramp syndrome [1].

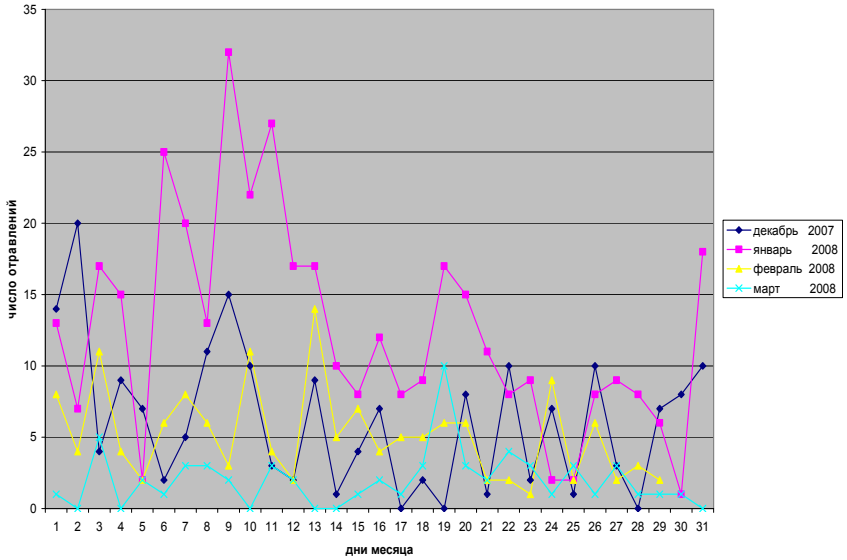

Fig.1 Dynamics of the number of acute CO poisonings in December 2007-March 2008 period

According to statistical data, a marked growth in the number of acute carbon monoxide poisonings has been witnessed in Azerbaijan during the last few years. The outcome of carbon monoxide poisonings depends on early diagnosis and qualified immediate medical aid.

Modern information technologies having enormous potentials and knowledge can serve ne of thr most important means of assistance and consulting for solving this problem. The employing of artificial intelligence methods, soft computation potentialities and the designing of databases, knowledge bases and databanks will render an inestimable assistance in the solution of the stated problem. The research proposes a design of an intelligent information system of monitoring, diagnosis and prognosis of carbon monoxide poisonings.

Due to an increase in the number of carbon monoxide poisonings the problem of necessity of taking both ptophylactic step and steps aimed at the improvement of immediate medical assistance rendered to the patients, becomes pressing .Fig .1 shows dynamics of carbon monoxide poisonings in Baku over a short period.

At the first stage it was planned to solve the problem relating to the accurate diagnosis and rendering immediate aid. But when investigating into a subject domain we encountered with two difficulties without obviating which the designing of similar system becomes senseless. The first difficulty consists in the fact that there can be situations and cases similar to carbon monoxide in their symptoms - there has arisen a burning demand for differential diagnosis as the difficulty of diagnosis is met with because one and the same symptoms and even syndromes may be observed in cases of poisonings by different toxic substances. Fig.2. gives a schematic representation of interrelation of kindred poisonings.

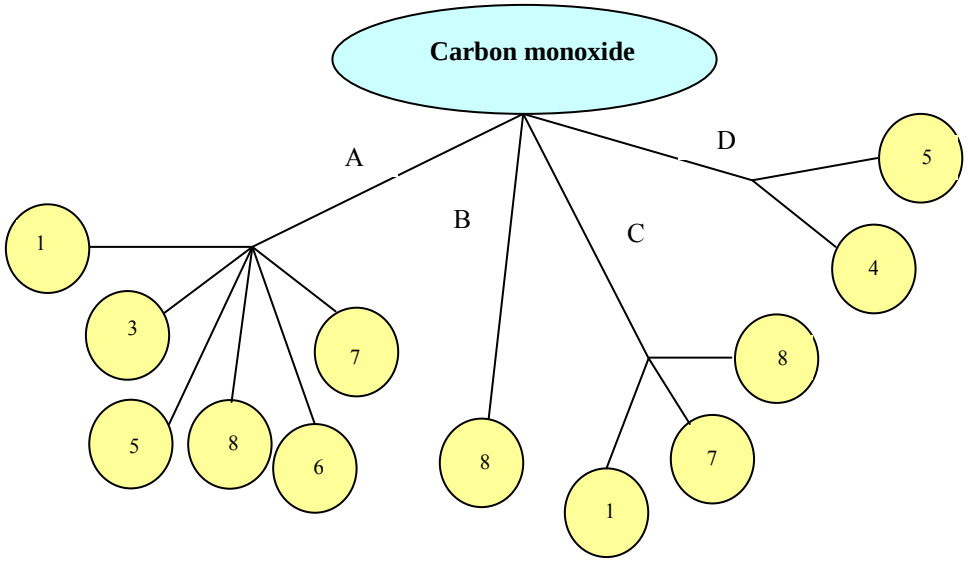

Fig 2. A fragment of network database on differential diagnosis of comatose states incases of coisonings by CO and other toxic substances: 1-anilin, 2-antihistaminic preparations, 3-atropin, 4-codein, 5-pachycorpin, 6-salicylates, 7-cyanides, 8-ethylenglycol.

The second difficulty is encountered with because the nature of poisonings depends on carbon monoxide concentration in the air (LAC-20 mg/m2), the duration of action and individual sensitivity of a person. If chronic intoxication is of reversible nature acute poisonings often leads to lethal outcome or to severe complications that can manifest themselves for a long time after the poisoning. Here a need for organizing monitoring service and for timely medical intervention becomes exident by way of example, there were observed cases of parkinsonism which developed several weeks following carbon oxide poisoning. There had also been registered cases of human deaths caused by consequences of poisoning two or three weeks after the event of poisoning. What is more, as the scientists from the Institute of Heart in

Minneaplis found out in 2006 [2], acute carbon monoxide poisoning can continue exertinga negative effect on health of people who had undergone this acute poisoning up to lethal outcome in the course of the nearest few years on acceunt of the damage which this poisonous substance inflicts upon cardiac muscle. The purpose of the research: development of utomatism in the actions of an ambulance doctor in extreme cases using carbon monoxide poisoning as an example; performance of differential diagnosis of similar situations with kindred symptoms; organization of monitoring and conduct of constant improvement as well as updating of knowledge of ambulance medical personnel at their place of work; preparation of training program for urgent therapy intended for students of medical educational institutions and ambulance doctors with the use of carbon monoxide poisoning as an example [3].

In doing so the following subtasks are solved:

- collection and systematization of information in subject domain in full volume;
- preparation of wanted data for performing differential diagnosis of similar situations with kindred symptoms;
- organization of continuous and periodical monitoring for persons poisoned by carbon monoxide;
- working out of training program for urgent therapy intended for students of medical educational institutions and ambulance medical personnel with the use of carbon monoxide poisonings as an example.

The following model of the system is proposed for solving the problem (Fig .3), B1, B2,...Bn- ambulance station crews, DMB - decision making block:

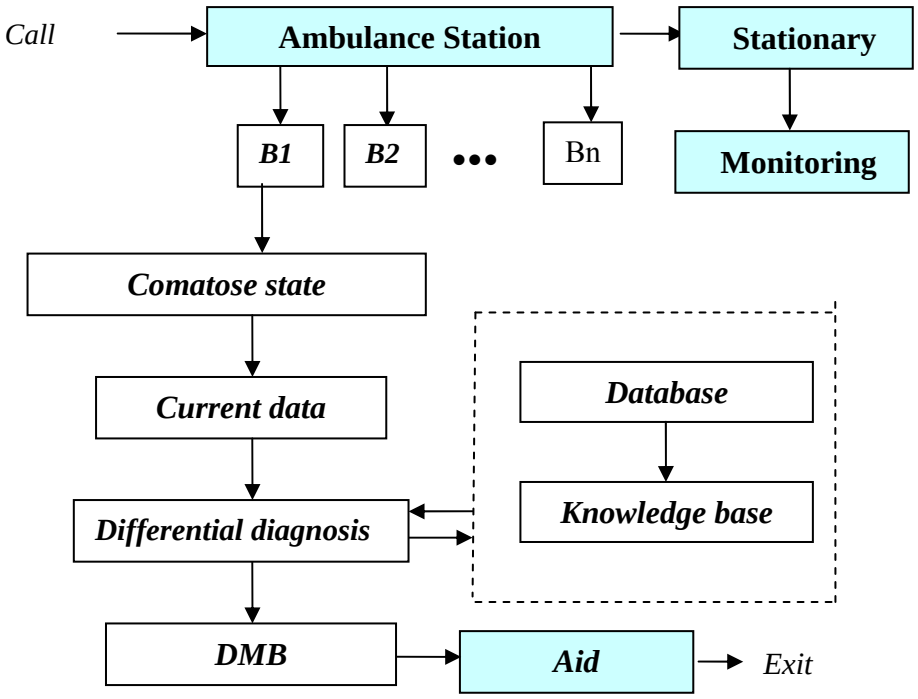

Fig.3. Conceptual model of intelligent information system (IIS) "Carbon monoxide"

Database is a network model organized in the form of a connected graph, it is very convennient for a training program. The procedure of training medical personnel and students is carried out using this model.

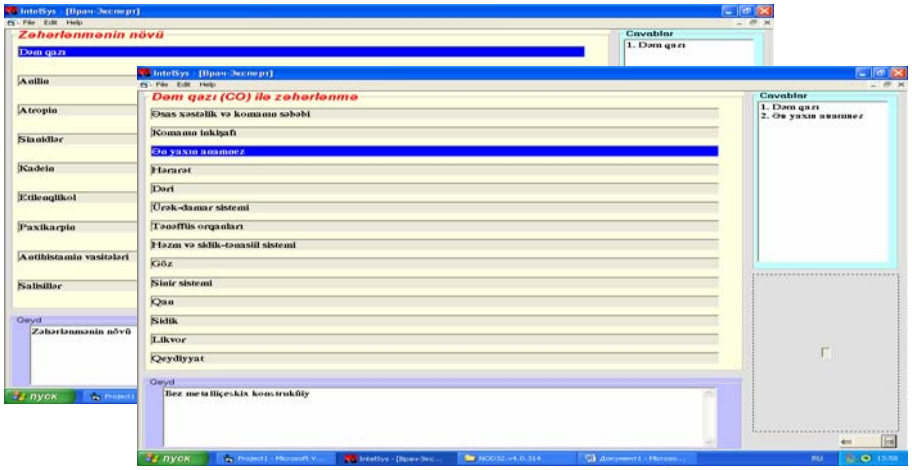

Fig. 4. A fragment of functioning of IIS "Carbon monoxide"

For diagnosis and prognosis we apply a relational model the use of which is justified by its mathematical rigour and simplicity in practice .In the decision-making block mathematical methods of statistics are employed .In the monitoring block mathematical methods for processing data obtained from various data media-such as ultrasonic diagnosis, electrocardiogram, blood analysis etc. are applied. Vbnm, bvbnnm cvbvnnmm

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