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NEGOVSKIY'S WORK ON RESUSCITATION OF CLINICALLY DEAD

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[Comment: The following is a review, by Prof A. Vishnevskiy, of V. A. Negovskiy's book Patofiziologiya i Terapiya Agonii i Klinicheskoy Smerti (Pathophysiology and Therapy of Agony and Clinical Death), published by Medgiz, Moscow, 1954.]

In his book, V. A. Negovskiy, Stalin Prize Laureate, seeks to familiarize practical physicians with the pathophysiology and therapy of agony and clinical death. USSR scientists have made an important contribution to the solution of the problem of resuscitation. Negovskiy states that, in 1871, I. Kostarev had already carried out an arterial transfusion to a septic patient [a patient suffering from septicemia]. This was the first arterial transfusion reported. Of great significance is the work of F. A. Andreyev, who opened up a new chapter in work on the problem of resuscitation.

After a detailed description of the method of restoring the vital functions of the organism which has been developed in the laboratory directed by him, Negovskiy discusses some typical characteristics of metabolism during extinction and restoration of vital functions of the organism. Chapter 2 summarizes the results of work by certain collaborators of Negovskiy. Chapter 2 also brings out the stage in the process of dying and in the cessation of vital functions at which disturbance of metabolism in tissues sets in.

Negovskiy discusses the problem of the sources of energy at the expense of which the restoration of vital functions, particularly those of the central nervous system, takes place. It is shown at what stage of resuscitation the restored nervous system assures the return of tissue metabolism to a normal state. Negovskiy demonstrates how aerobic metabolism is gradually replaced by glycolysis as the terminal conditions develop and divisions of the central nervous system are gradually eliminated.

As clinical death sets in, there is a reduction of the level of glycolysis. The sources which supply energy to the brain tissue are greatly impoverished at this stage. Creatine phosphate is completely absent, while the content of glycogen and of easily hydrolyzable phosphate (adenosine triphosphoric acid) is reduced to a minimum.

The first stage of the restoration of the central nervous system takes place mainly at the expense of glycolysis. Only at the end of the first hour of resuscitation, when the cerebral cortex is revived and its bioelectrical currents are completely restored, is there transition from the glycolytic to the oxidative way of the utilization of carbohydrates. According to Negovskiy, the state of oxygen starvation of an organism which has been subjected to clinical death continues until the functions of the cortex of the large hemisphere are restored more or less completely and the organism acquires the capacity to switch on the cortical compensatory mechanisms, if necessary. Negovskiy arrives at the conclusion that the restoration of the carbohydrate metabolism to normal depends on the time at which the functioning of the cerebral cortex has been restored.

In Chapter 3, the fundamental laws regulating the restoration of cardiovascular activity are expounded, and a theoretical treatment of intra-arterial centripetal transfusion of blood under pressure is given. It is noted that


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restoration of the normal metabolism of the heart by administration of oxygen and of nourishing substances is closely connected with irritation of the receptor apparatus.

Experimental data show that when the receptors of the arterial blood path are depressed, it is not possible to restore effectively the functioning of the cardiovascular system. In Negovskiy's book, the importance of the restoration of a high level of neural regulation of the activity of the cardiovascular system is emphasized. In complete accordance with the work done by Academician K. M. Bykov, Negovskiy shows that restitution of the cortical level of regulation of the cardiovascular system is the most important and conclusive condition for the restoration of that system.

Chapter 4 clarifies the dynamics of the restoration of respiratory activity. Negovskiy convincingly demonstrates that reflex stimulation is the most effective method of restoring the respiratory activity. This restoration is achieved by artificial respiration by a respirator which assures that air is blown into the lungs. For successful resuscitation, early restoration of the functioning of the bulbar centers is of great importance.

The nature of the extinction and restoration of cortical and subcortical functions during the process of dying and restoration of vital functions of the organism is clarified in Negovskiy's book. The author also shows that the functioning of the cerebral cortex ceases at the earliest stage during the process of dying and is restored last during the process of resuscitation. In accordance with I. P. Pavlov's and E. A. Asratyan's work, Negovskiy shows the prominent role which the cerebral cortex plays in the compensation of disturbances that occur in an organism subjected to clinical death.

The author pays considerable attention to an analysis of those disturbances of the cerebral cortex which may take place in resuscitated patients who have suffered a long clinical death. Negovskiy remarks with justification that the problem of resuscitation of a higher organism amounts substantially to restoration of the functioning of the cerebral cortex.

In discussing the complex method of restoring the vital functions of the body, the author summarizes experience acquired in clinical application of this method to treat terminal conditions brought about by lethal blood loss, acute shock, agony, and clinical death. In the clear, detailed chapter dealing with this problem, he outlines the procedures to be followed by a surgeon when arterial transfusion of blood is applied in cases of hemorrhage that cannot be stopped.

The book pays particular attention to surgical anesthesia carried out in terminal states brought about by factors which require surgical interference. Experimental results and clinical observations carried out by the author have shown that deep anesthesia, when combined with blood losses or intoxication (as, for instance, in peritonitis, sepsis, or intestinal obstructions), may result in the same serious consequences as clinical death which has continued for more than 5-6 minutes.

In conditions of this kind, the positive effect of applying local anesthesia according to A. Vishnevskiy's method is brought out (see page 197). It is shown that local anesthesia does not subject to a strain the nervous system which has been traumatized by anemization or by other factors which may result in the development of terminal conditions.

In conclusion, the author discusses problems which require immediate experimental and clinical study. The author states that, although fundamental investigations must still be carried out, all achievements in the field of therapy of terminal conditions which are already available should be applied at clinics, particularly at the surgical and obstetric-gynecologic clinic.

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Although the book is generally quite good, it has some faults. The most important fault is uneven treatment of some problems. Some chapters are not as well written as others and there is a lack of experimental data on the investigation of the conditioned-reflex activity in resuscitated animals. There is an absence of data on Negovskiy's clinical observations on the dynamics of extinction and restoration of the second signal system. As far as this problem is concerned, the author limits himself to an analysis of published data. There is also a lack of information on supplementary methods for the treatment of patients who had suffered clinical death and had been revived.

Nevertheless, on the whole, Negovskiy's book presents in a sober and objective manner data pertaining to the problem of the resuscitation of vital functions of the organism. It is permeated with a spirit of optimism and of firm assurance that Soviet science will solve this important problem successfully on the basis of extensive correlation of theoretical investigations with clinical procedures and procedures applied in practical medicine. In general, there can be no doubt that Negovskiy's book is destined to become a valuable manual for physicians, primarily surgeons and obstetricians.

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