
POST RESUSCITATION DISEASE

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The study of processes taking place in an organism after a terminal state (severe hypoxia in any form or circulation arrest) and of revival has shown that in the post-resuscitation period a complex of pathological processes develops in all organs and in the organism as a whole.

They are caused by severe hypoxic damage combined with reperfusion and reoxygenation and by the pathological changes that appear in a diseased organism forced to resist the processes leading to its death.

The combination of the above changes and processes and their dynamics in time does not correspond to the term "syndrome".

The same syndrome can be observed in different nosological units.

While disease is an independent complex of pathological processes governed by certain laws and including a number of interrelated syndromes.

A post-resuscitation pathological process has its own etiology, unique pathogenesis and clinical dynamics and requires a specific professional and often prolonged treatment.

For a long time neither in Soviet, nor in foreign literature we have met objections to the term "post-resuscitation disease" that we suggested about 25 years ago. Only recently some scientists began to replace this term by another - "post-resuscitation syndrome".

We think our definition to be more legitimate and to stand the test of time.

RESTORATION OF ARTIFICIAL RESPIRATION

Artificial ventilation is a first step in resuscitation. Undoubtedly one can not always use modern apparatus for artificial ventilation in emergency. We must limit ourselves to the instruction of laymen in immediate, without wasting a second, delivery of air into the lungs via a tube, inserted into the mouth or air delivery from mouth-to-mouth or mouth-to-nose via gauze. Very often when an artificial ventilation apparatus is used, the resuscitator after observing a patient taking the first independent breaths, immediately takes away the tube, via which air went into the lungs, and switches off the ventilator, which forced this air.

A long resuscitation experience has shown, that this is a major error in resuscitation which often ends tragically, leading to death of the central nervous system. There is a firm rule: not to be late with the beginning of the artificial ventilation and not to discontinue its prematurely. Only after a number of respiration tests and clinical trials, sometimes carried on during 1-2 weeks, it is possible to begin a gradual discontinuation of artificial ventilation via an apparatus.

RESTORATION OF CARDIAC FUNCTIONS

Here, as well as in artificial ventilation, 2-3 minutes' delay can make it impossible to fully revive an organism after clinical death.

Cardiac massage should be sufficiently strong, i.e. during cardiac compressions blood must reach the cerebral cortex and the nearest subcortex and not only medulla oblongata and middle brain. Maximum blood pressure in such massage must be not less than 100 mm Hg. Otherwise, as it is unfortunately rather frequently observed, independent respiration appears, while the higher brain section does not revive, and resuscitation loses its sense. The heart as the whole cardiovascular system after a period of dying, and in some cases clinical death, should be looked upon as an ill organ, cardiological therapy is one of the essential elements of its further restoration. Here we greatly count on aid and recommendations by cardiologists.

HEART FIBRILLATION AND DEFIBRILLATION

Sudden fibrillation of the heart can be the main reason of organism's death. Besides, it can appear at any stage of resuscitation. In both cases defibrillation becomes the central element of the resuscitating process. Essential statements of the theory of fibrillation occurrence and development were put forward by N.L. Gourvitch in the 1940-s and have been supplemented and extended during the subsequent decades by the scientists from the Institute of general reanimatology of the USSR AMSci (earlier called laboratory). The theory of the development of ventricular fibrillation worked out by him, is based on circulation of excitation, stimulated by morphological peculiarities of the myocardium and conducting system.

In fibrillation, coordinated cardiac contractions are disturbed after a preliminary stage consisting of groups of extrasystoles with progressively increasing frequency. These disturbances are caused by the fact that the rhythm is not assimilated by the least viable elements of the conducting system, and that further excitation stops to be assimilated by more viable elements. This stimulates the for-

mation of zones of single-directional conduction blockade and creates prerequisites for continuous excitation circulation according to the "re-entry" principle.

On this theoretical basis he worked out a principally new method of transthoracic electrical heart defibrillation, the essence of which lies in excitation synchronization while powerful current impulses are imposed on the heart. He also constructed impulse defibrillators, first industrial samples of which appeared in our country in early 1950-s, i.e. ten years earlier, than abroad (M.S. Bogushevich, V.Ya. Tabak, V.A. Macarytchev, V.A. Vostrikov, V.I. Cherniy^{sb} et al.).

Our Institute as well as a number of other laboratories and clinics have confirmed the influence of defibrillating electrical current on the heart. This fact urged to look for a decrease of its dose with preserved effectiveness of the impulse; prolonged investigations led to a conclusion about the expediency of using bipolar form of a defibrillating impulse, the effectiveness of which is increased twice on account of summing the peak values of both semiwaves. Later on, this impulse was called "Gourvitch's impulse". Defibrillators, generating bipolar Gourvitch's impulses, were created jointly with the Scientific Production Association of Radioelectronic Medical equipment (SPa REME, Lvov; designer-in-chief Venin).

Analysis of huge experimental material about comparative effectiveness and safety of mono- and bipolar impulses made it possible to conclude, that if defibrillating effect is achieved by summed stimulating action of both semi-waves, then damaging action is defined by the absolute action of current of one direction (N.L. Gourvitch, 1975).

It is possible to massage the fibrillating heart? It is possible and necessary. Certainly it will be less effective, but before a physician's arrival or delivery of the defibrillator, it is indispensable. One should not ignore such a useful fact, that in the overwhelming majority of cases defibrillation should be conducted after a short indirect heart massage, which will

stimulates the transfer of weak fibrillation into active one, which is much easier to stop or preliminarily use the method of centripetal blood pumping.

ENDOGENOUS INTOXICATION

The development of a terminal state, regardless of its reasons, is accompanied with hypoxia, dramatic metabolism disturbance in some organs and tissues and consequently - endogenous intoxication. Damaged detoxication and removal systems of the organism also intensify endogenous intoxication. Studies of blood plasma toxic activity, carried out in our Institute by the gel-chroma-tography method, have shown that it is to a great extent induced by toxic formations with a molecular mass 500 to 10000 D ("medium size molecules). Nowadays the most effective extracorporeal methods of detoxication are hemoperfusion and plasmapheresis. Decreased pathogenic influence of endotoxin upon the brain in the early postresuscitation period leads to a fuller and quicker restoration of the CNS functions and makes it possible to reach full restoration of organism's functions after prolonged circulation arrest, usually incompatible with full revival.

One of the most severe manifestations of cardiac insufficiency in ischemic heart disease in resuscitated patients is pulmonary edema. We have achieved good clinical results using the method of isolated ultrafiltration to treat this pathology.

RESTORATION OF THE CENTRAL NERVOUS SYSTEM

The most difficult and essential thing in resuscitation is to revive the brain. The cerebral restoration may be delayed or may be partial, then a patient will require further neurologic treatment.

There may be variants when cerebral cortex and the nearest subcortex have been damaged so greatly, that they will never be able to

restore (inspite of all therapeutic methods used) - cases of brain death. Reanimatology is a neurologic science. Resuscitator's main attention must be paid to the brain.

Thus, for example, we have to regard the loss of consciousness as the first stage of the developing process of dying, as a protective inhibition, which is a kind of evolutionally protective reaction. The cerebral cortex thus spares itself from the process of active and exhausting fight at the final stages of dying. During revival the cortex is known to be the last to restore, i.e. when other vital functions have already restored and when the decisive phase of the process of dying has been left behind. One can not ignore the fact that stable restoration of cardiovascular functions during revival takes place only from the moment of restoration of nervous influences on the heart activity, because at the onset of this process the heart, conventionally speaking, revives as a functionally denerved organ; the brain is known to suffer most in terminal states.

Patients, discharged from the resuscitation unit, i.e. after this or that stage of terminal states (in a certain percentage of cases-clinical death), had these or those psychoneurologic disturbances. Sometimes they appeared even 2-4 months after discharge. This refers even to patients without substantial neurologic disturbances in the resuscitation unit. Evidently any physical or psychic marker can serve to reveal psychoneurologic vulnerability of patients, discharged from the hospital. In a number of observations patients with complete clinical neurologic restoration have substantial EEG disturbances.

Rehabilitation therapy, conducted since the first hours of terminal state (amelioration of microcirculation and metabolic processes in cerebral cells, use of health improving drugs, hyperbaric oxygenation and so on), will decrease the number and markedness of psychoneurologic disturbances and accelerate the process of psychoneurologic stabilization and social readaptation (G.V. Alekseeva). Patients in the resuscitation department are often in coma.

As it has been shown, the later restores the consciousness, the more severe complications are observed in all somatic organs. Thus we can make a cardinal conclusion: it is necessary to help the brain restore its functions as soon as possible, because the revived brain will help restore other functions in a most perfect and reliable way - it will not cure, it will just give substantial help.

Unlike the processes of dying, the cerebral cortex resumes its direct functions - of the leading regulator and distributor of the organism's vital activity. Life comes into its own.

Let me make a short conclusion, which

may be not so much of medical, but rather of philosophical character. Any aspect of resuscitation is always a touch upon the mystery of life and death, it is a scientific realization of man's ancient dream to fight death. Now we know reasonable limits to this fight, but revival of any person is always perceived by a resuscitator as "Ode to joy", and subconsciously at this moment we start to recollect the motive of the 9th Symphony by Beethoven. Successful resuscitation of a patient is the greatest reward to the physician in his hard, and by far not always successful fight for the life of a dying man.

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