

SCENAR-therapy (bioregulated electrostimulation) in the treatment of multisystem craniocerebral injury

Among all multisystem injuries craniocerebral injuries are the most severe and appear in 26-89% of time with 76% lethality (E.K.Gumanenko and others, 1983).

Severe craniocerebral injury is currently considered to be a traumatic brain injury, causing impairment of patient's consciousness by 3-8 scores according to glasgow coma scale by its evaluation in no less than 6 hours after the trauma has been acquired in conditions of orthopedic alignment correction, hypoxia and lack of any intoxication and hypothermia.

Nowadays, all key specialists in the field of neurotraumatic surgery are unanimous that brain trauma by severe craniocerebral injuries is defined not only by primary impact at the moment of getting the trauma, but also by the impacts of other disturbing factors during the next hours and days, these are so-called factors of secondary brain injury. The severity of primary brain injury presupposes the outcome at pre-admission stage or during the first hours after getting the trauma, whereas clinical prediction as well as acute and long-term periods in the aftermath of severe craniocerebral injuries depend on secondary injury factors development and impacts.

Primary brain injury, which is connected with the impacts of damaging forces at the moment of trauma, includes: neurons and glia cells injury, junctional ruptures, ruptures and cerebral thrombosis. Primary brain traumatic injury can be diffusive (diffuse axonal injury, diffuse vascular injury) or local (brain contusion, crushing, axons local injury, vascular disruption followed by intracranial hematoma).

Secondary brain injury factors are directly connected with the mechanism of primary brain injury, but always develop later on and result in medullar substance affection mainly by hypoxic and ischemic type.

The most dangerous secondary brain injury factors are arterial hypotension, hypoxia and intracranial hypertension.

Multisystem craniocerebral injuries result in blood hypocirculation, caused by severity of extracranial injuries, except for lower stem form of severe craniocerebral injuries, which tends to hypo circular type of central hemodynamics. The latter brings to decrease of oxygen delivery to the brain and coming out of this hypoxia. Blood hypo circulation by lower stem form of severe craniocerebral injuries is connected with higher regulatory activity disorder, prevailing of urgent adaptation processes over the long-term ones, the results of which are rapid depletion of body and failure of adaptation.

The use of transcranial Doppler in the treatment of multisystem craniocerebral injuries allows defining two types of cerebral circulation change: cerebral vasospasm and vasogenic brain edema. Transcranial Doppler signs of cerebral arteriospasm are observed in 76,4% of craniocerebral injuries with the given type of spasm being revealed during the first day after trauma and characterized as soft spasm. Later, it increases and reaches its maximum by the fifth day; afterwards it is stabilized at the achieved level. (V.I. Badalov, 1998)

The severity of cerebral angiospasm is directly dependent on the expression of subarachnoid hemorrhage. Weak subarachnoid hemorrhage correlates with soft cerebral angiospasm, the expressed angiospasm is revealed by massive subarachnoid hemorrhage, and appears to be critical in separate observations.

Transcranial Doppler signs of intracranial pressure increase as the expression of vasogenic brain edema are revealed only when the injured have severe forms of craniocerebral injuries and defined beginning from the first day after getting trauma, and reach their maximum expression on the second or third day.

Secondary brain injury factors are characterized as intracranial (intracranial hypertension, dislocation syndrome, cerebral angiospasm, convulsions, intracranial infections) and extracranial (arterial hypotension, hypoxemia, hypercapnia, etc).

Therefore, the main task of suitable treatment with the symptoms mentioned is to prevent secondary brain injury. In other words, secondary brain injury parameters are to be corrected according to modern conceptions to achieve intensive care of the injured with brain traumatic injuries.

By the treatment of the injured with multisystem injuries, when severe craniocerebral injuries are the primary component of severity, the attention should be paid to the elimination of reasons, which caused secondary brain injury factors. It is, first of all, patency of airways management, adequate breathing recovery, circulating blood volume rapid recovery, introduction of inotropic drugs in case of myocardium insufficiency. Early prevention of mainly extracranial secondary brain injury factors adds to treatment results improvement of the injured. Moreover, adequate therapy aimed at the treatment of brain injuries primary nidus, is held.

The treatment of the injured with severe craniocerebral injuries is a rather difficult task. The high level of lethality even in specialized treatment centers with the application of wide range of medicines creates the necessity of new effective treatment methods search.

Bioregulated electrostimulation devices have been successfully used in field – military surgery for three years to cure the injured with multisystem severe traumas, the primary component of which is a craniocerebral injury. Such devices allow simulating bipolar impulses of alternating current, identical by their parameters to nerve fibers impacts potentials.

Initially, it was thought reasonable to apply such devices in nervous system injuries treatment as masses most available to the influence of the given electro impulses. The developers and researchers consider that biologically active neuropeptides, possessing a number of peculiar properties, are formed as a result of electric impulses effects in the body.

Neuropeptides, along with other humoral regulators, form functional continuity (continuum), providing the realization of any combined biological activities. By craniocerebral injuries brain malfunctions bring to central nervous system regulatory action disbalance. The possibility to normalize brain functions and increase its regulatory action with the means of bioregulated electrostimulation devices served as the base for treatment of the given category of injured. The apparatus SCENAR-035 (“Ritm” design office (RITM OKB), Taganrog) was applied. The affected zones were main facial craniocerebral nerves exit sites, eyelids, as well as biologically active points in the projection of vertebral and carotid arteries, cervical zone. Cerebral vasospasm, as a leading link of secondary brain injury from the very first hours after getting the trauma requires target influence on the zones, responsible for vascular tone. By taking into account the results of transcranial Doppler, certifying beginning from the first hours after getting the trauma “soft” cerebral vasospasm with its subsequent intensification, SCENAR-therapy should be started as soon as possible, at least during 24 hours after trauma. The most important affected zone must be the projection of great foramen, making it possible to affect the value of intracerebral liquor pressure. Thus, it can be considered, that SCENAR-therapy gives a real opportunity of affecting some secondary brain injury factors. Moreover, neuropeptides being generated have a general regulatory action on the body of an injured.

Treatment sessions were held daily, sometimes twice a day. A procedure took 40-60 minutes. Treatment course consisted of 12-18 procedures, in average. And the therapy was performed both in resuscitation department from the very first hours after receiving the trauma, and surgical department.

Treatment results were estimated in accordance with electroencephalography data. In 30 minutes after stimulation the tendency to brain bioelectric activity indexes normalization was marked, which was defined either by beta-rites frequency decrease and appearance of alpha-rites, or low frequency potential number decrease. Clinically brain suppression signs decrease was observed and proved by growth of glasgow coma scale up to 10 and more scores. Consciousness was recovered more quickly, brain stem functions (breathing, blood circulation)

were normalized. "Severe" artificial pulmonary ventilation was replaced by supplementary pulmonary ventilation mode, and later by independent breathing. Depending on the severity of primary brain injury a number of injured experienced surgical treatment. SCENAR-therapy positive results in postoperative period were not so considerable in case of the injured with apparent brain substance injury symptoms and it didn't influence trauma outcome in whole. As a rule, the injured died during the next days and hours. More optimistic results were received in cases of severe craniocerebral injuries, without any indications for surgical treatment. Conservative treatment was combined with SCENAR-therapy. Successful treatment of 9 injured with severe craniocerebral injuries (of them was operated by the cause of subdural hematoma by heavy cerebral contusion) gives a hope for further successful application of the given method in the treatment of such injured, as well as those with hypoxic encephalopathy.