IMPROVING THE DIAGNOSIS OF SENSORY DISORDERS IN TRAUMATIC MIDFACIAL INJURIES ACCOMPANIED BY ORBITAL FLOOR FRACTURES

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ABSTRACT

Among the bone fractures of the midface, blow-out fractures amount to 11-28% and occupy the third place after zygomatic and zygomatic arch fractures and fractures of nasal bones. According to our observations izolated orbital bottom fractures occurred in 8.9% of cases. With the blow-out fracture, the presence of clinical signs of neuritis of the infraorbital nerve is an important pathognomonic symptom indicating the localization of bone fracture at the orbital floor. The main factors that determine the rate and quality of unprompted recovery of affected functions and, accordingly, the scope and target of the therapeutic interventions in cases of peripheral traumatic neuropathies include: the degree of nerve guide lesion, the level of destruction, tissue ischemia, the kind of the disturbing factor. When the nerve is constricted, the degree of conductivity failure depends primarily on the duration and intensity of constriction injury. Research objective was to improve diagnostics of traumatic lesions of infraorbital and zygomatic nerves in patients with blow-out fractures. Clinical, radiological, neurofunctional and biochemical methods of research were applied in 19 patients, aged 20 to 65 years, with blow-out fractures. The degree of destruction of infraorbital and zygomatic nerves was assessed by classification of H. Seddon (1943), which allows determining the degree of lesion of the nerve trunk according to the changes in conductivity in each of its segments. The degree of lesion of the branches of the maxillary nerve was determined according to the data of electrophysiological tests according to Nechaieva N.K. et al. (2014). Electrodiagnostics of sensitivity of skin branches of maxillary nerve was carried out in their exit sites on the surface of face using low-frequency electrotherapy device "Radius-01 FT" (Belarus) in the mode of electrical stimulation. Electroodontometry of teeth on the corresponding side of the upper jaw was carried out using a portable electroodontometer "Pulptester" (Taiwan). In the peripheral venous blood of patients, there was determined the concentration of neuron-specific enolase (NSE), which is a neuron-specific isoform of enolase found in neurons. It was analyzed by an immunochemical method with the use of electrochemiluminescent detection, using a Cobas 6000 analyzer and test system by Roche Diagnostics (Switzerland). Statistical processing of the results of research was carried out with the help of a computer program for statistical computation "Statistica 8".We found a mild degree (neuropraxia) of damage to the orbital nerve in 12 patients. The content of neuron-specific enolase in the blood did not exceed the upper limit of normal - 15.9 ± 1.4 ng / ml ($p > 0.05$). Sensitivity disorders of the teeth and soft tissues in the area of innervation of the

suborbital and zygomatic nerves in all patients in this group were temporary. The sensitivity of the damaged nerves completely recovered after 3 - 4 weeks. The presence of axonotmesis of the suborbital and zygomatic nerves in seven patients caused severe sensory disturbances in the soft tissues of the suborbital and zygomatic areas, loss of sensitivity in the upper jaw teeth on the side of the injury. These pathological changes were identified to be caused by their compression of the orbital floor by bone fragments, which were displaced into the maxillary sinus. In their blood, such patients had an increased concentration of neuron-specific enolase, which exceeded the upper limit of normal - 20.6 ± 1.7 ng / ml ($p < 0.01$). In this category of patients, sensitivity, as a rule, completely recovered in 1,5 - 2 months after operations on reconstruction of the orbital bottom and after a course of drug therapy.The use of electrophysiological tests and study in the blood of the nervous tissue damage marker- neuron-specific enolase allow us to identify the degree of damage to the suborbital and zygomatic nerves in patients with isolated fractures of the fundus.

KEY WORDS: orbital floor fracture, traumatic neuropathy of the infraorbital and zygomatic nerves, neuron - specific enolase.

INTRODUCTION. Damage to the orbital bones is combined with injury of other bones of the skull frontal part (zygomatic - maxillary complex, naso - frontal - ethmoidal complex) in 40% of cases [1 - 4]. Among the bone fractures of the midfacial zone, isolated fractures of the orbit make up 11-28% and occupy the third place after fractures of the zygomatic bone and arch and nasal bones [5]. An isolated orbital fracture usually occurs as a result of a direct blow to the eyeball. Under the influence of mechanical energy, the anatomical integrity of the orbital floor is destroyed, because its arched upper wall is more resistant to deformation than the almost flat bottom, which is easier to deform and break. Its bones and adjacent soft tissues are pressed into the underlying cavity of the maxillary sinus. The medial wall is also thin, but it is strengthened at the back by ethmoid bone cells, like buttresses [1]. This type of orbital fracture is called - "orbital explosive" fracture.

According to our observations over the period from 2014 to 2017, among the patients who were treated in the Department of Maxillofacial Surgery of the Municipal City Clinical Emergency Hospital of Lviv with the facial skull fractures, isolated "explosive" orbital floor fractures were found in 12.5% of cases. Fractures of the orbit walls are almost always accompanied by concussion. With such localization of a face injury, the following local clinical symptoms are most characteristic: hematoma of an orbit and a periorbital site – 89.65%, hypostasis of soft tissues – 96.55%, diplopia – 58.1%, disorders of sensitivity of soft tissues, adjacent to the orbit (hypoesthesia, paresthesia), in the area of innervation of the infraorbital nerve - 35.5%, limited movement of the eyeballs - 9.7%, enophthalmos - 3.2% [6, 7]. In case of orbital injury, the presence of clinical manifestations of suborbital nerve neuropathy is an important pathognomonic symptom, which indicates the possible localization of the fracture at the bottom of the orbit [8]. The main factors that determine the duration and quality of recovery of nerve functions in traumatic neuropathies include: the nature of the damaging agent, the severity of damage to the nerve trunk, the level of damage, tissue ischemia. When the nerve is compressed, the degree of conduction disturbance depends primarily on the duration and intensity of

compression [9]. It is also necessary to take into account the topographic and anatomical features of the localization of the infraorbital nerve at the bottom of the orbit, which has an individual variability of position in the infraorbital sulcus and the eponymous canal [10, 11]. Prolonged compression of the nerve trunk develops degenerative changes [12]. Based on a retrospective analysis of case histories, we found that the incidence of chronic traumatic neuritis of the suborbital and zygomatic nerves in patients with fractures of the fundus reaches 28.6% of cases. When treated traditionally, this pathological condition restores the function of the damaged nerves in 2,5 - 3 months.

THE PURPOSE OF THE STUDY: to improve the diagnosis of neuropathy of the suborbital and zygomatic nerves in traumatic midface injuries accompanied by fractures of the fundus.

RESEARCH METHODS. Clinical, neurofunctional and biochemical methods were performed in 19 patients aged 20 to 65 years old with isolated "explosive" orbital floor fractures. The degree of damage to the suborbital and zygomatic nerves (taking into account the dynamic clinical observation) was evaluated according to the classification of N. Seddon (1943) [13], which allows to determine the degree of nerve trunk damage by changes in conduction in each segment and distinguish 3 types of complications: 1. neuropraxia - a predominant lesion of the myelin sheath, which does not lead to axonal death. It most often occurs with compression or mild injury. Manifestations: decreased vibrational, proprioceptive, and sometimes tactile sensitivity (pain sensitivity suffers much less often), as well as paresthesia. Symptoms gradually regress as myelin recovers; 2. axonotmesis - the predominant lesion or death of the axon while preserving epineuria, perineuria, endoneuria and Schwann cells. It most often occurs when the nerve is compressed or stretched. It occurs in moderate injuries. Manifestations: more pronounced disorders of sensory and autonomic nerve functions. Restoration of functions is not always complete; it can last for several months; 3. neuromesis - rupture of the nerve with the intersection of axons and membranes. Manifestations: complete loss of these nerve functions. Two-three weeks after the rupture of the nerve trunk, traumatic neuroma occurs at the central end. The prognosis for recovery is unfavorable. The degree of damage to the branches of the maxillary nerve was determined according to electrophysiological tests by the method of Nechaev N.K. et al. [14].

The obtained values of electrosensometry are interpreted as follows: the indicators of electrical sensitivity of the facial skin are normally 25 -35 μa, the pulp of the teeth - 6 - 10 μa. Given the values of electropotential (EP) of facial skin 45-55 μA and electroodontometry (EOD) of teeth 12 - 25 μA, a temporary violation of nerve conduction is diagnosed, which indicates a slight degree of nerve damage (neuropraxia); average degree of nerve damage (axonotmesis) - EP of facial skin 55-80 μA and EDI of teeth 26-50 μA; severe nerve damage (neuromesis) - EOD of teeth 51-100 μA, EP of facial skin 80-150 μA. Electrodiagnostics of sensitivity of superficial branches of a maxillary nerve was carried out by imposing sensors on skin in a projection of their exit on a face surface. To do this, we used the device "Radius-01 FT" (Belarus) in the mode of operation - electrical stimulation. The following guidelines were chosen for this purpose: the sensitivity of the zygomatic-temporal nerve was tested 15.0 + 0.5 mm

lateral to the frontal-zygomatic suture and 23.0 + 0.5 mm above the upper edge of the zygomatic arch [15, 16], the facial nerve was tested at a point of 8.5 + 0.5 mm lateral to the lower outer corner of the orbit and 24.0 + 0.5 mm lower than the frontal-zygomatic suture [17, 18], and the suborbital nerve was diagnosed at a point located 6.7 ± 1.62 mm below the lower edge of the orbit (at the level of the chin - maxillary suture) and 17.5 ± 0.5 mm medially from the pear-shaped hole [19, 20].

Measurement of electrical sensitivity of dental pulp on the corresponding side of the upper jaw was performed by electroodontodiagnostics (EOD), which was performed using a portable digital electroodontometer "Pulptester" (Taiwan).

In the peripheral venous blood of patients, the concentration of neuron-specific enolase (NSE), which is a neuronspecific isoform of enolase that occurs in neurons, was determined. The level of NSE increases in the nervous system diseases, accompanied by a fairly rapid destruction of neurons, so it is used in the diagnosis and assessment of the prognosis of recovery from the nervous system lesions of various origins (traumatic, ischemic). This was examined by immunochemical method with electrochemiluminescent detection, using an analyzer and test system Cobas 6000, Roche Diagnostics (Switzerland). The reference value of NSE is up to 16.3 ng / ml.

Statistical processing of the obtained research results was performed using a computer program of statistical calculations "Statistica 8".

RESULTS AND DISCUSSIONS.

Twelve patients with the orbital floor fracture without displacement of bone fragments were found to have a slight degree of damage to the suborbital nerve (neuropraxia). A radiological examination showed the fracture line passing through the infraorbital canal or infraorbital sulcus in seven patients. During electrosensometry they were diagnosed a decrease in the sensitivity of the skin in the projection of the orbital foramen on the affected side - 52.4 ± 3.7 μA ($p < 0.05$) and the sensitivity of the pulp of the teeth of the upper jaw (incisors, canines and premolars) - EOD 24.9 ± 1.8 μA ($p < 0.01$). If the fracture line passed through the lower orbital fissure (5 cases), such patients also showed neuropraxia of the zygomatic nerve branches. Dysfunction of these nerves was due to their compression by hematoma, edema, adjacent nerves, tissues. The content of neuron-specific enolase in the blood did not exceed the upper limit of normal - 15.9 ± 1.4 ng / ml ($p > 0.05$). Sensory disorders of the tissues of the midfacial zone in these patients were temporary.

Seven patients were diagnosed with significant dysfunction of the suborbital and zygomatic nerves (axonotmesis), which caused the appearance of severe sensory disorders in the soft tissues of the suborbital and zygomatic areas - EP skin 68.9 ± 4.7 μA ($p < 0,01$) , in the teeth of the upper jaw on the side of the injury - EOD teeth 45 ± 3.5 μA. Among the causes of persistent neuropathy of the branches of the maxillary nerve were: damage by bone fragments of the nerve sheath and fibers, their compression by hematoma, inflammatory exudate.

In the blood of such patients, the concentration of neuron-specific enolase was increased, which exceeded the upper limit of normal - 20.6 ± 1.7 ng / ml ($p < 0,05$).

In this category of patients, the sensitivity of the soft tissues of the midfacial area and the area of the upper jaw teeth (incisors, canines and premolars) on the affected side in most cases was restored in

full from 1.5 to 2 months after surgical reconstruction of the orbit and the course complex drug therapy (Fig. 1). Against the background of neurotropic treatment, the levels of neuron-specific enolase in the blood gradually normalized (Fig. 2), which directly correlated with the data of electrodiagnostics of the sensitivity of the studied branches of the maxillary nerve. The concentration of this biochemical marker of nervous tissue in the blood of patients had approached to normal by the 30th day from the start of treatment of traumatic neuritis of the suborbital and zygomatic nerves - 16.9 ± 1.3 ng / ml (p> 0.05).

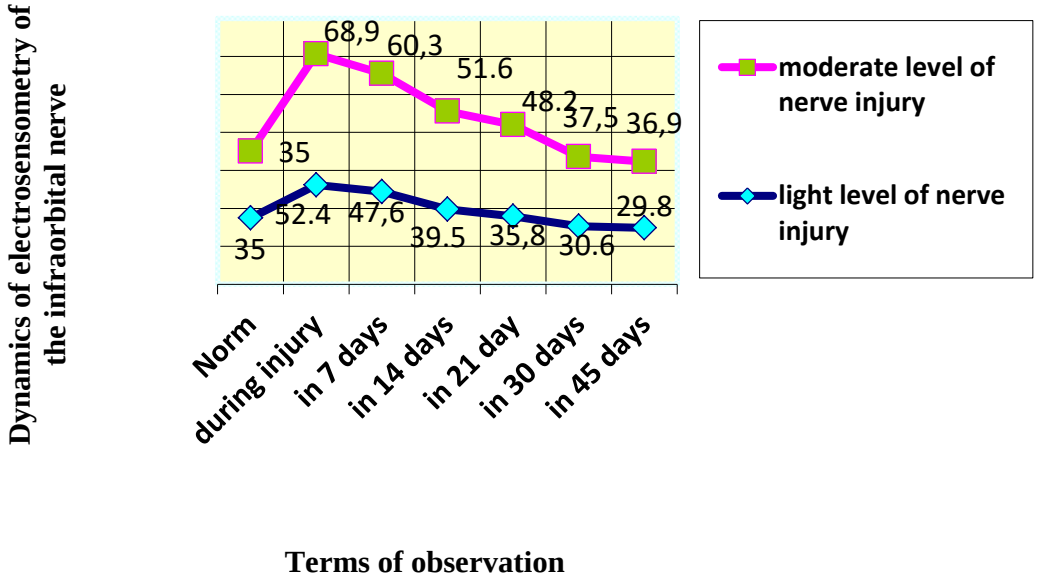

Figure 1. The dynamics of electrosensometry of the infraorbital nerve depending on the degree of damage during fracture of the orbital floor bones.

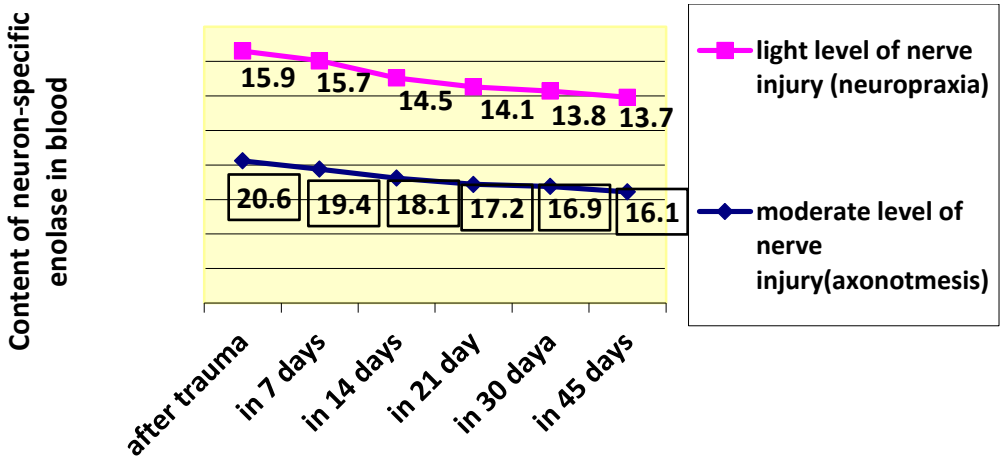

Fig. 2. Dynamics of blood content of neuron-specific enolase in traumatic neuropathy of the infraorbital and zygomatic nerves on the background of their treatment.

Conclusions. The use of electrophysiological tests and study in the blood of the nervous tissue damage marker- neuron-specific enolase allow us to identify the degree of damage to the infraorbital and zygomatic nerves in patients with isolated orbital floor fractures.

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