

ORIGINAL ARTICLE

EFFECTIVENESS OF CORRECTION OF PSYCHO-EMOTIONAL STRESS IN CHILDREN WITH TRAUMATIC INJURY TO SOFT TISSUES AND FACIAL BONES

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ABSTRACT

The aim: To study the effectiveness of correction of psycho-emotional stress in children with traumatic injuries of the tissues of the maxillofacial area.

Materials and methods: A comprehensive examination and treatment of 58 children aged 3 to 15 years with traumatic injuries of the maxillofacial area were conducted during the period of 5 years. This applied to soft tissue injuries in 51.7% of cases and in 48.3% - to facial bone injuries. To test the severity of the psycho-emotional state, two homogeneous groups were formed in a total of 41 persons of primary and secondary school age.

Results: A comparison of the results of our previous studies, which concerned only the fact of psychological testing and changes in vegetative balance in children with traumatic injuries with a group of patients who underwent comprehensive treatment with additional involvement of targeted psychoneuropharmacological correction allowed to establish, that this approach made it possible to eliminate vegetative disorders and reduce the degree of stress in them for 9-10 days from the time of hospitalization.

Conclusions: In children with traumatic injuries of soft tissues and bones of the face, dysregulation of vegetative function and intensity of compensatory-adaptive mechanisms of the body with the predominance of the central mechanism of regulation. With the additional involvement of the drug "Noofen[®]" in the complex of therapeutic measures, it allows to stabilize their psychological state, which indicates its effectiveness.

KEY WORDS: children, traumatic injuries, stress, correction

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INTRODUCTION

The steady increase in the number of injuries of the maxillofacial area, difficulties in diagnostic of bone's fractures, the development of postoperative complications after damaging of soft tissue determines the importance of this issue. According to the thematic literature, the most common causes of this problem are road accidents (41.3%), domestic problems (39.6%) and sports (13.0%). Traumatic injuries occur mainly in children aged 6 to 14 years (65.0%), and 35.0% occur in 4-5 year old children, who are dominated by soft tissue injuries. At the same time, boys suffer twice as often as girls [1 - 4].

In such cases, the question of pain is quite acute, because the child's process of arousal, which determines the severity of fear and direct perception of pain, prevails over the mechanisms of inhibition. In addition, it should take into account the age-related functional, anatomical and topographical features of the maxillofacial area and the individuality of the manifestations of psycho-emotional reactions under conditions in which children find themselves. It should be remembered, that the pain is part of nociceptive afferent reactions with signs of a stimulating effect on certain parts of the central nervous system and it can be a source of the development of a dominant protective reaction. [5, 6].

Feelings of fear and a negative psycho-emotional attitude to the surrounding reality, in such cases and without appropriate pharmacological support, can lead to neurovegetative and somatic disorders that need to be corrected. A significant number of tools and methods, including sedation with different groups of nootropic drugs have been proposed for prevention of the consequences of stressful situations. At present, in specialized medical institutions the medical preparation of the child on the eve of carrying out certain professional manipulations is widely enough applied. [7, 8, 9].

The development of modern psychotropic drugs, which have an original and diverse spectrum of pharmacological activity, in the presence of minor side effects, low toxicity, high selectivity, allows them to be used successfully in neurotic and psychopathic conditions accompanied by anxiety and fear. Therefore, the correction of psycho-emotional state in children with traumatic injuries of the soft tissues of the maxillofacial area can be a guarantee of the effectiveness of their treatment at all stages of observation [9, 10, 11].

THE AIM

To study the effectiveness of correction of psycho-emotional stress in children with traumatic injuries of the tissues of the maxillofacial area.

Table I. Distribution of children with traumatic injuries depending on the degree of anxiety

Degree of anxiety	Type of damaged tissue							
	Soft tissue injury				Facial bone injury			
	Without correction (n = 22)		With correction (n = 21)		Without correction (n = 21)		With correction (n = 20)	
	abs.	%	abs.	%	abs.	%	abs.	%
Low	-	-	-	-	-	-	-	-
Moderate	8	36,4	12	57,1	8	38,1	11	55,0
High	14	63,6	9	42,9	13	61,9	9	45,0

Table II. Indicators of central hemodynamics in patients with traumatic soft tissue injury depending on the degree of anxiety and it's correction (M±δ)

Indicator	Control group (n=20)	Number of patients and degree of anxiety							
		Treatment without correction				Treatment with correction			
		at the time of hospitalization (n=22)		after 9 - 10 days of treatment (n=22)		at the time of hospitalization (n=21)		after 9 - 10 days of treatment (n=20)	
		Moderate (n=8)	High (n=14)	Moderate (n=8)	High (n=14)	Moderate (n=12)	High (n=9)	Moderate (n=11)	High (n=9)
SBP, mm.Hg	105,4±8,1	126,6±3,1 p ₁ < 0,05	136,5±5,2 p ₁ < 0,05	106,4±4,2 p ₂ > 0,05 p ₃ > 0,05	112,7±9,2 p ₂ > 0,05 p ₃ < 0,05	128,1±4,2 p ₁ < 0,05	141,1±5,6 p ₁ < 0,05	107,6±5,7 p ₂ > 0,05 p ₃ > 0,05	102,8±6,1 p ₂ > 0,05 p ₃ < 0,05
DBP, mm.Hg	68,2±4,8	82,3±4,7 p ₁ < 0,05	84,7±5,1 p ₁ < 0,05	77,5±3,6 p ₂ > 0,05 p ₃ > 0,05	72,4±4,1 p ₂ > 0,05 p ₃ > 0,05	81,7±5,1 p ₁ < 0,05	87,1±6,7 p ₁ < 0,05	71,3±6,4 p ₂ > 0,05 p ₃ > 0,05	68,5±3,7 p ₂ > 0,05 p ₃ < 0,05
Respiration rate, in min.	26,7±0,9	37,2±1,3 p ₁ < 0,05	40,2±5,2 p ₁ < 0,05	32,6±1,4 p ₂ < 0,05 p ₃ > 0,05	34,3±2,3 p ₂ < 0,05 p ₃ > 0,05	35,7±1,5 p ₁ < 0,05	41,5±4,6 p ₁ < 0,05	27,1±2,8 p ₂ > 0,05 p ₃ < 0,05	27,3±2,1 p ₂ > 0,05 p ₃ < 0,05
Heart rate, in min.	89,4±3,9	121,7±7,4 p ₁ < 0,05	130,1±4,5 p ₁ < 0,05	98,7±6,1 p ₂ < 0,05 p ₃ < 0,05	105,9±5,1 p ₂ < 0,05 p ₃ < 0,05	113,9±8,3 p ₁ < 0,05	131,7±5,1 p ₁ < 0,05	85,4±4,1 p ₂ > 0,05 p ₃ < 0,05	84,5±4,2 p ₂ > 0,05 p ₃ < 0,05
Hildebrandt coefficient, unit	3,5±0,08	3,8±0,07 p ₁ > 0,05	4,2±0,1 p ₁ < 0,05	3,6±0,1 p ₂ > 0,05 p ₃ > 0,05	3,3±0,2 p ₂ > 0,05 p ₃ < 0,05	4,0±0,2 p ₁ > 0,05	4,9±0,2 p ₁ < 0,05	3,2±0,2 p ₂ > 0,05 p ₃ < 0,05	3,4±0,1 p ₂ > 0,05 p ₃ < 0,05
Continuation of Table II									
Kerdö's Vegetative Index, unit	18,2±2,1	22,6±2,3 p ₁ < 0,05	26,3±2,9 p ₁ < 0,05	21,8±2,7 p ₂ < 0,05 p ₃ > 0,05	22,9±3,4 p ₂ < 0,05 p ₃ < 0,05	22,6±3,8 p ₁ < 0,05	28,0±2,4 p ₁ < 0,05	19,6±3,2 p ₂ > 0,05 p ₃ < 0,05	21,1±2,2 p ₂ > 0,05 p ₃ < 0,05
Minute volume, l / min	1,8±0,06	2,2±0,3 p ₁ < 0,05	2,8±0,4 p ₁ < 0,05	1,9±0,2 p ₂ > 0,05 p ₃ > 0,05	2,2±0,2 p ₂ < 0,05 p ₃ > 0,05	2,4±0,3 p ₁ < 0,05	3,1±0,3 p ₁ < 0,05	1,7±0,1 p ₂ > 0,05 p ₃ < 0,05	2,2±0,3 p ₂ < 0,05 p ₃ < 0,05

Notes:

1. p₁ – the probability of the difference between the indicators of the control group and patients at the time of hospitalization.
2. p₂ – the probability of the difference between the indicators of the control group and patients at the time of recovery.
3. p₃ – the probability of the difference between the indicators in patients at the time of hospitalization and at the time of recovery.

MATERIALS AND METHODS

During the period from 2016 to 2021, in the clinic of the Department of Pediatric Surgical Stomatology of the Ukrainian Medical Stomatological Academy were conducted a comprehensive examination and treatment of 58 children with traumatic injuries of the maxillofacial area at the age of 3 to 15 years, who were hospitalized in the surgical department of Poltava Pediatric City clinical hospital. Among these patients, 30 children (51.7%) had soft tissue injuries without penetration into the oral cavity

and 28 children (48.3%) had bone fractures, which were accompanied by the preservation of the integrity of the mucous membrane. In order to objectively assess the results of the study, of these 41 patients aged 7 to 15 years, according to the nature of the injury, two homogeneous groups were formed. The number of children involved in in-depth research was: 21 out of 30 patients with soft tissue injuries and 20 out of 28 patients with facial bone injuries. The control group is represented by 20 healthy individuals of the same age.

Table III. Indicators of central hemodynamics in patients with traumatic injury of the facial bones, depending on the degree of anxiety and its correction ($M \pm \delta$)

Indicator	Control group (n=20)	Number of patients and degree of anxiety							
		Treatment without correction				Treatment with correction			
		at the time of hospitalization (n=22)		after 9 - 10 days of treatment (n=22)		at the time of hospitalization (n=21)		after 9 - 10 days of treatment (n=20)	
		Moderate (n=8)	High (n=14)	Moderate (n=8)	High (n=14)	Moderate (n=12)	High (n=9)	Moderate (n=11)	High (n=9)
SBP, mm.Hg	105,4±8,1	129,7±7,1 $p_1 < 0,05$	132,9±6,3 $p_1 < 0,05$	106,1±5,3 $p_2 > 0,05$ $p_3 < 0,05$	114,8±9,6 $p_2 > 0,05$ $p_3 > 0,05$	128,9±8,3 $p_1 < 0,05$	133,5±8,4 $p_1 < 0,05$	104,7±6,5 $p_2 > 0,05$ $p_3 < 0,05$	106,9±8,1 $p_2 > 0,05$ $p_3 < 0,05$
DBP, mm.Hg	68,2±4,8	80,5±6,4 $p_1 < 0,05$	83,2±4,3 $p_1 < 0,05$	75,7±4,1 $p_2 > 0,05$ $p_3 > 0,05$	74,3±5,6 $p_2 > 0,05$ $p_3 > 0,05$	78,7±7,1 $p_1 < 0,05$	84,5±5,1 $p_1 < 0,05$	68,5±5,7 $p_2 > 0,05$ $p_3 > 0,05$	67,3±5,3 $p_2 > 0,05$ $p_3 < 0,05$
Respiration rate, in min.	26,7±0,9	37,4±2,5 $p_1 < 0,05$	38,1±3,4 $p_1 < 0,05$	32,6±2,1 $p_2 < 0,05$ $p_3 > 0,05$	33,4±2,3 $p_2 < 0,05$ $p_3 > 0,05$	38,8±2,4 $p_1 < 0,05$	39,2±3,1 $p_1 < 0,05$	27,3±2,3 $p_2 > 0,05$ $p_3 < 0,05$	26,5±2,6 $p_2 > 0,05$ $p_3 < 0,05$
Heart rate, in min.	89,4±3,9	119,7±8,2 $p_1 < 0,05$	123,4±7,5 $p_1 < 0,05$	96,9±7,2 $p_2 < 0,05$ $p_3 < 0,05$	101,2±4,7 $p_2 < 0,05$ $p_2 < 0,05$	118,8±7,8 $p_1 < 0,05$	128,6±8,4 $p_1 < 0,05$	86,2±5,6 $p_2 > 0,05$ $p_3 < 0,05$	81,9±4,7 $p_2 > 0,05$ $p_3 < 0,05$
Hildebrandt coefficient, unit	3,5±0,08	3,8±0,06 $p_1 < 0,05$	3,9±0,05 $p_1 < 0,05$	3,7±0,2 $p_2 > 0,05$ $p_3 > 0,05$	3,5±0,3 $p_2 > 0,05$ $p_3 > 0,05$	4,7±0,2 $p_1 < 0,05$	5,2±0,3 $p_1 < 0,05$	3,6±0,4 $p_2 > 0,05$ $p_3 < 0,05$	3,6±0,3 $p_2 > 0,05$ $p_3 < 0,05$
Continuation of Table III									
Kerdö's Vegetative Index, unit	18,2±2,1	22,7±2,3 $p_1 < 0,05$	26,3±2,9 $p_1 < 0,05$	21,8±3,4 $p_2 < 0,05$ $p_3 > 0,05$	22,9±2,7 $p_2 < 0,05$ $p_3 < 0,05$	22,6±3,2 $p_1 < 0,05$	28,0±2,4 $p_1 < 0,05$	19,6±3,2 $p_2 > 0,05$ $p_3 < 0,05$	21,1±2,4 $p_2 > 0,05$ $p_3 < 0,05$
Minute volume, l / min	1,8±0,06	2,1±0,2 $p_1 < 0,05$	2,3±0,3 $p_1 < 0,05$	2,2±0,2 $p_2 < 0,05$ $p_3 > 0,05$	2,4±0,2 $p_2 < 0,05$ $p_3 > 0,05$	2,5±0,3 $p_1 < 0,05$	2,7±0,4 $p_1 < 0,05$	1,9±0,2 $p_2 > 0,05$ $p_3 < 0,05$	1,7±0,2 $p_2 > 0,05$ $p_3 > 0,05$

Notes:

1. p_1 – the probability of the difference between the indicators of the control group and patients at the time of hospitalization.
2. p_2 – the probability of the difference between the indicators of the control group and patients at the time of recovery.
3. p_3 – the probability of the difference between the indicators in patients at the time of hospitalization and at the time of recovery.

Patients were hospitalized as soon as possible, and, if necessary, with the involvement of support specialists. Examination of patients included interviews with children and their relatives, as well as clinical, additional and special research methods. First of all, we assessed the general condition of patients, clarified their complaints and the time that elapsed after the injury, and also specified the scope and time of primary medical care [3].

Assessment of the child's internal perception of the situation was performed in a test form, and stress resistance was determined using a modified color psychological Luscher test. Along with general clinical examination methods, systolic and diastolic blood pressure (SBP, DBP) were measured, heart rate (HR) was recorded, minute circulating blood volume was determined, and, in order to establish the presence of vegetative changes in the nervous system, was determined of the Kerdö's Vegetative Index and Hildebrandt coefficient [12]. The study was conducted at the time of hospitalization and for 9 - 10 days after it, in a separate isolated room under friendly relations and circumstances. The obtained data were subjected to statistical processing by using of the generally accepted methods [13].

RESULTS

Having studied the structure of diseases according the nosological forms in children, who were hospitalized for treatment, it was found that the share of traumatic injuries of the maxillofacial area accounted for 58 cases (6.7%) of the total number of patients with surgical dental pathology. Among this children the soft tissue injuries were in 3,4% of cases, and facial bone injuries in 3,3% of cases. Among them, there were 1.8 times more boys than girls, and the main age groups were represented by junior and senior school groups - 70.0% and 71.4%, respectively, the type of injured tissues.

The generalization of anamnestic data in patients with soft tissue injuries revealed that in 14 out of 30 cases (46.7%) the cause was both domestic and stray dogs, in 10 children (33.2%) it was a consequence of domestic and street accidents, and by 2 cases (6.7%) were cats, traffic accidents and other causes. Regarding the distribution of traumatic injuries of facial bones, it was found that domestic injuries accounted for 12 out of 28 cases (42.9%), traffic accidents - 7 (25.0%) cases, sports injuries - 5 (17.9%) and

4 (14.2%) observations involved other causal factors. It should be noted that in both groups with correction, the moderate degree of anxiety were prevailed (table 1).

In the case of soft tissue lesions, the majority of patients (19 children, 63.3%) were aged between 7 to 15 years and they sought for medical care within the first day after the injury, 9 patients (30.0%) - on the second day and 2 patients (6.7%) in the longer term. The pre-hospital treatment at the place of residence were reduced mainly to the treatment of wounds with antiseptic and for applying of a bandage. To ensure the primary surgical treatment of wounds in hospital conditions in 17 patients (60.7%) various types of general anesthesia were used and in 11 patients (39.3%) it was performed under local anesthesia, but in all cases it was preceded by premedication.

The largest share of bone injuries also occurred in the age group from 7 to 15 years (19 children, 67.9%). At the same time, 23 patients (82.3%) were hospitalized with fractures of the mandible of different localization. A combination of several injuries was observed in 3 patients (10.6%) and in 2 patients (7.1%) were diagnosed a fracture of the upper jaw. During the first two days after the injury, 13 out of 28 children (46.4%) sought for medical care and all others (15 children, 53.6%) within 3 to 5 days. It should be noted, that 21 patients (75.0%) were referred for treatment with incorrect diagnoses and only 6 out of 28 patients (21.4%) were provided with medical care at the place of residence, however, it was not provided in full volume. Anesthesia was not used for these patients.

The nature of clinical manifestations in both observation groups depended on the type of damaged tissue and the severity of the injury, but in each case they had individual characteristics. Specialized medical care was provided in accordance with the relevant protocols, but its scope also depended on the clinical situation, and of course, after written agreement with relatives.

Our previous studies on the manifestations of stress reactions in children with traumatic injuries of various tissues of the maxillofacial area revealed that they have psycho-emotional stress and disorders of vegetative regulation, which arose against the background of increased hemodynamic parameters [14]. A comparison of statistically processed averaged data showed that at the time of hospitalization, the indicators did not differ significantly in the researching groups, both in soft tissue injuries and facial bone injuries. In general, the direction of changes in indicators shows a decreasing of the body's adaptive capacity and dysregulation of the vegetative functioning of the circulatory and respiratory systems (table II, III). Therefore, in the future we paid attention only to the coverage of the results obtained in both groups after 10 days from the time of hospitalization.

There is no doubt that this situation requires measures to normalize the vegetative balance, because the autonomic nervous system plays an important role in ensuring the proper functioning of organs and systems [15]. Recently, scientists are paying attention to Noofen®, which has pronounced nootropic properties and has been extensively

tested in children with various somatic diseases. Due to the fact that it is a derivative of GABA and phenylethylamine, it has vegetative stabilizing, nootropic, anti-anxiety properties, it improves the work of higher nervous activity, and at the same time it has no significant side effects [8, 9]. Therefore, we decided to test and evaluate its effectiveness in the treatment of children with traumatic injuries of the maxillofacial area. To compare the results in the comparison groups, in one of them, in addition to the generally accepted volume of treatment measures, Noofen® in capsules in a dosage of 250 mg three times a day for 10 days was additionally prescribed.

After a course of treatment of patients with soft tissue injuries according to the treatment protocol, which lasted 9-10 days, it was found, that with an moderate degree of anxiety at the time of examination, compared with the day of hospitalization, there was a normalization of SBP, DBP, respiratory rate, Hildebrandt coefficient, Kerdö's vegetative index, minute volume, however, heart rate, remained in 1.2 times higher. Also, respiratory rate, heart rate, Kerdö's vegetative index did not reach control values and remained 1.2 times higher.

With a high degree of anxiety at the time of recovery, compared with the time of hospitalization, the values of DBP, respiratory rate returned to normal, and SBP, heart rate, Kerdö's vegetative index, minute volume remained 1.2 times higher, and Hildebrandt coefficient 1.3 times higher. In comparison with the indicators of the control group there was a normalization of SBP, DBP and Hildebrandt coefficient. However, the minute volume differed in groups by 1.2 times, and respiratory rate, heart rate, Kerdö's vegetative index remained 1.3 times higher.

In children with traumatic facial bone injuries, on 9-10th day of treatment, regardless of the degree of anxiety, there is normalization of SBP, DBP, respiratory rate, Hildebrandt coefficient, Kerdö's vegetative index and minute volume. However, their heart rate remained elevated in 1.2 times. Comparing the values of these indicators with their values in the control group, it was found that SAD, DBP, Hildebrandt coefficient and Kerdö's vegetative index in children with moderate degree of anxiety reached the values of healthy children. In group with moderate degree of anxiety, there is a level of respiratory rate, heart rate, minute volume was higher in 1.2 times, and in children with high levels of anxiety - Kerdö's vegetative index and minute volume were higher in 1.2 times, and respiratory rate and heart rate - in 1.3 times higher than in the control group.

In both groups, in which Noofen® was additionally involved in the treatment complex, all indicators returned to the control values at 9-10th day. Comparing the results obtained at the time of hospitalization and at the time of recovery in patients with soft tissue injuries and in comparison groups, it was found that in patients with moderate anxiety, respiratory rate, heart rate, Hildebrandt coefficient, Kerdö's vegetative index improved by 1.3 times, and the minute volume - in 1.4 times. In the group with a high degree of anxiety, the level of DBP decreased by 1.3 times, SBP, Hildebrandt coefficient, Kerdö's vegetative index,

minute volume by 1.4 times, respiratory rate by 1.5 times, heart rate by 1.6 times.

In the group with traumatic bone injury and moderate anxiety, CAT was 1.2 times higher, Hildebran's ratio and minute volume 1.3 times higher, and respiration rate and heart rate 1.4 times higher. At a high level of anxiety, SBP improved in 1.2 times, DBP and Kerdö's vegetative index in 1.3 times, Hildebrandt coefficient in 1.4 times, respiratory rate – in 1.5, heart rate and minute volume – in 1.6 times. Such results indicate the tangible benefits and high efficacy of Noofen® in the treatment of traumatic facial tissue lesions in children.

DISCUSSION

In the occurrence of psychovegetative disorders in children, the leading role belongs to stress, which is accompanied by physiological, neuropsychological and metabolic changes in the body. Children who have received traumatic injuries of the maxillofacial area and who have manifestations of imbalance in the regulation of the nervous system are no exception [14]. This confirms the need for use in them as part of a comprehensive treatment of neurotransmitters. Noofen® has proved to be quite effective in pediatric practice in the treatment of somatic diseases [8,9]. However, the specifics of the formation of psychological manifestations has its own characteristics, which depend on age, type of disease, individual perception of the situation. In addition, trauma is a very aggressive factor in the formation of feelings of fear, phobias, emotional and autonomic reactions and manifestations of psychological stress, which significantly affects the tactics of treatment of this category of patients. Unfortunately, the number of scientific papers is very limited and relates mainly to statistical analysis of injuries, the peculiarities of the causal factors and the provision of emergency medical care [1-4]. The solution of the issues of psychological rehabilitation of such children remains out of consideration, which prompted us to conduct research in this direction. Thanks to our efforts, it has become possible to eliminate the manifestations of post-traumatic trail reaction and confirm the effectiveness of Noofen® in children, which makes its use promising in cases of traumatic injuries of the maxillofacial area.

CONCLUSIONS

In children with traumatic injuries of soft tissues and bones of the face at the time of hospitalization there is a tension of adaptive-compensatory mechanisms, which indicates an imbalance of autonomic regulation with a predominant violation of the cardiovascular system and respiratory system. In both observation groups, with moderate and high degree of anxiety, for 9-10 days from the beginning of treatment without the use of psychoneuropharmacological drugs there was a positive tendency to improve the indicators that characterize the vegetative status, but most of them did not reach the control values. It should be noted that with a high degree of anxiety, these changes were more

pronounced. Additional application of pharmacological correction of psychoemotional state by Noofen® allowed to achieve a pronounced vegetative-stabilizing effect in the absence of side effects. Comprehensive treatment for 10 days had a positive effect on the normalization of central hemodynamics and tone of the autonomic nervous system. This leads to a rethinking of the stereotype regarding the feasibility and rationality of wider use in pediatric trauma practice of drugs that have nootropic properties.

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