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# Collaboration of specialists in the rehabilitation of spine pathology

*Współpraca specjalistów w zakresie rehabilitacji patologii kręgosłupa*

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## Abstract

To study the influence of the negative psychological state of children and adolescents living on the territory of hostilities, on the formation and course of spinal pathology. The sample consisted of 1467 people aged 5–18-year-old, whose parents had no complaints of the child's spinal pathology, i.e. "relatively healthy children in respect of spinal pathology." The growth of pathology of the spine during periods of intensive growth of the child was confirmed: in the 5–7-year-old age group for 3.49% of children, in the 8-10-year-old age group for 13.78%, in the 10-14-year-old age group for 17.89%, in the 15–17-year-old age group for 25.15% respectively. An increase in the prevalence of scoliosis in the Donetsk oblast (excluding the temporarily occupied territories) at the level of 28.26 cases per 1,000 schoolchildren, which is more than in other regions of Ukraine. The similarity of the pathogenesis of scoliosis, stress, and hypercalciuria was determined, which explains the data obtained by us on the prevalence of scoliosis in the ATO area, actually 95.89 cases per 1000 children, and 251.53 cases per 1000 adolescents aged 15-18-year-old. The manifestations of autonomic disturbances ( $r_s = 0.34$ ,  $p \leq 0.01$ ), sleep disturbances ( $r_s = 0.43$ ,  $p \leq 0.01$ ), anxiety ( $r_s = 0.43$ ,  $p \leq 0.01$ ) is increased among children with significant fear of war. There is a need to consider scoliosis as a stressor, and therefore children with scoliosis should get psychological rehabilitation and expert advice.

## Key words:

scoliosis, stress, hypercalciuria, children, adolescents, rehabilitation

## Streszczenie

Zbadanie wpływu negatywnego stanu psychicznego dzieci i młodzieży żyjących na terenie działań wojennych, na powstawanie i przebieg patologii kręgosłupa. Próba składała się z 1467 młodych osób w wieku 5-18 lat, których rodzice nie zgłaszali patologii kręgosłupa u dzieci, czyli były to „dzieci stosunkowo zdrowe pod względem patologii kręgosłupa”. Potwierdzono wzrost patologii kręgosłupa w okresach intensywnego wzrostu dziecka: w grupie wiekowej 5-7 lat u 3,49% dzieci, w grupie wiekowej 8-10 lat u 13,78%, w grupie wiekowej 10-14 lat u 17,89%, w grupie wiekowej 15-17 lat u 25,15%. Zaobserwowano wzrost zachorowalności na skoliozy w obwodzie donieckim (z wyłączeniem terytoriów czasowo okupowanych) na poziomie 28,26 zachorowań na 1000 uczniów, czyli więcej niż w innych regionach Ukrainy. Określono podobieństwo patogenezy skoliozy, stresu i hiperkalciurii, co wyjaśnia uzyskane przez nas dane dotyczące rozpowszechnienia skoliozy w obszarze ATO, tj. 95,89 przypadków na 1000 dzieci i 251,53 przypadków na 1000 młodzieży w wieku 15-18 lat. Objawy zaburzeń autonomicznych ( $r_s = 0,34$ ), ( $p \leq 0,01$ ), zaburzeń snu ( $r_s = 0,43$ ), ( $p \leq 0,01$ ), lęki ( $r_s = 0,43$ ), ( $p \leq 0,01$ ) są większe u dzieci doświadczających znacznego lęku przed wojną. Skoliozę należy traktować jako stresor, dlatego dzieci ze skoliozą powinny skorzystać z rehabilitacji psychologicznej i porady eksperta.

## Słowa kluczowe:

skolioza, stres, hiperkalciuria, dzieci, młodzież, rehabilitacja

## Introduction

The state of health of the youngsters is one of the important indicators of the well-being of society and the country, which reflects the forecast for the future in times of stress. The issue of stress somatization and post-stress is widely studied by scientists, but the impact of stress on the musculoskeletal system remains poorly described.

One of the common diseases of the musculoskeletal system is scoliosis, the frequency of which ranges from 2 up to 25% [4, 9]. Much attention is paid to the study of the etiology, pathogenesis of scoliosis, and rehabilitation of patients with scoliosis [5, 10, 11, 12, 13, 14, 15, 16, 18, 20]. I.A. Movshovych, combining many theories, considers scoliosis to be a multifactorial disease, where a significant role is played by the general pathological background of the body: hormonal disturbances and metabolism [17]. The latter can change under the influence of stress.

In recent years, publications on the psychological state of a patient with scoliosis have appeared: J. Rullander et al. [17], A.E. Sanders et al. [19] and others consider scoliosis not only as a medical issue but also as a psychological one. They also noted that the disease is not an isolated stressor, but should be considered in combination with many other stressors.

Military actions, information, and psychological impact on the population of Eastern Ukraine is an emergency that threatens the lives of children and adults, and also acts as a stressor in the formation of chronic psychological stress, causes reduced adaptability, the emergence of pain, namely psychopathological manifestations among children: phobias, disturbances sleep, emotional and autonomic reactions, anxiety, fears, depression, negativism, general mental stress, which in turn lead to behavioral disturbances at the social, interpersonal and intrapersonal levels [1, 19]. Stress causes functional changes in the immature body of children and adolescents [8]. Underestimation is the factor of information security of the child: uncontrolled and long-term use of Internet resources, gadgets in combination with the forced position of the body, leads to a decrease in physical activity and negatively affects the child's posture. The action of the information-psychological component of hybrid warfare leads to the emergence of various functional pathologies [2, 3, 7]. Children of Donetsk and Luhansk oblast have been living in a state of chronic psychogenic stress for six-year-old. The child's participation in stressful events or information about this event causes deep and clinically significant pathological conditions (long-term depression, tendency to loneliness, high anxiety, low self-esteem, decreased school performance) [6, 8]. Thus, children who live in the territory of hostilities and have the pathology of the spine, are valuable for research by modern science and practice.

## Object

To study the influence of the children and adolescents living on the territory of hostilities negative psychological state on the formation and course of spinal pathology.

## Materials and methods

The research was conducted in the State Institution "Scientific and Practical Medical Rehabilitation and Diagnostic Center of

the Ministry of Health of Ukraine" within the R&D program "Development of a system of medical and psychological assistance to children and adolescents in the territory of the anti-terrorist operation (ATO)" (state registration number 0116U004162). The sample consisted of 1467 people aged 5-18-year-old, whose parents had no complaints regarding their child's spinal pathology, i.e. "relatively healthy children in respect of spinal pathology." The children formed the following groups by age: 5-7-year-old age group - 671 people, 8-9-year-old age group - 264 people, 10-14-year-old age group - 408 people, 15K18-year-old age group - 124 people.

All children were examined by a multidisciplinary team (Pediatrician, Pediatric Cardio-Rheumatologist, Orthopedist, Otolaryngologist, Physiotherapist, Psychologist, Medical Psychologist, and Neurologist according to the prescriptions. All children underwent general clinical examinations: (blood test, clinical analysis), biochemical analysis to determine blood serum, calcium, and urine levels, functional studies were performed to objectify the patient's condition: electromyography (EMG), electroencephalography (EEG), dynamometry, electrocardiogram (ECG), spirometry, ultrasound of the thyroid gland; determination of blood oxygenation and heart rate (HR), echocardiography (ECHO-CS), Holter monitoring, rheoencephalogram (REG), echo-encephalography (ECHO-EC), Doppler ultrasound examination of the vessels of the head and spine according to the prescriptions.

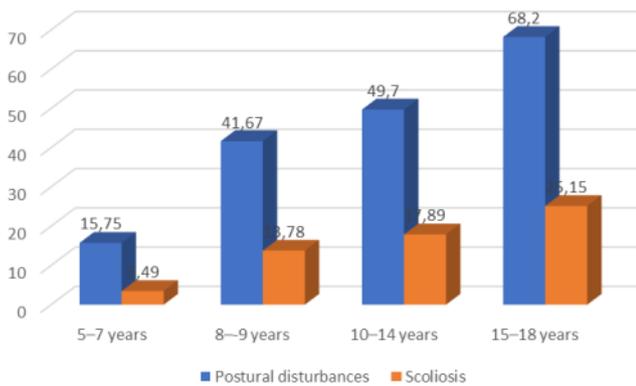
The following methods were used for the age category of 5-7-year-old: author's card of clinical-psychological and social examination of the child, "Locomotive" method (S.V. Velieva), Fear Questionnaire (A.I. Zakharov); "Cactus" projective methods (M.O. Panfilova), "Non-existent animal" (M.Z. Drukarevich), "Family drawing" (G.T. Khomentauskas); questionnaire to determine anxiety and aggression of children (G.P. Lavrentyeva and T.M. Titarenko); "10 words", "Remember the picture", "Find and cross out" methods for 5-year-old children, "Proofreading" (B. Bourdon) for 6-7-year-old children, "Pictures Story".

For the age category of 10-14-year-old: G. Eisenko's temperament questionnaire; "Children's questionnaire of neuroses" (Sednev V.V., Zbarsky Z.G., Burtsev O.K.); diagnosis of aggression according to the method of A. Bass-A. Darka; "Draw your fear" techniques; metaphorical associative cards (COPE cards set).

In this area of research and rehabilitation of children with spinal pathology, the specialists of the State Institution "Scientific and Practical Medical Rehabilitation and Diagnostic Center of the Ministry of Health of Ukraine" interacted with Prof. Z.Slivinsky and specialists of the Department of Psychiatry, Psychotherapy, Narcology and Medical Psychology of Donetsk National Medical University. The individual rehabilitation program includes physiotherapeutic procedures widely used in Poland: electrophoresis with drugs, neurostimulation, exercise therapy, various types of massage. Electromyostimulation with the use of the Miorhythm 186 device, magnetic therapy, laser therapy, hydromassage, work on the ENtree M Pulley took their place. The use of individual, group and family programs is a contribution to the study of rehabilitation of patients with scoliosis and postural disturbances. Combination of different types of massage, a wide combination of physiotherapy procedures, the prescription of vitamin D3.

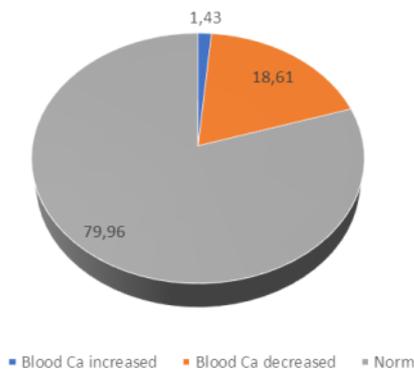
**Research results and discussion**

A multidisciplinary team studied the somatic state of children and adolescents. Changes in the cardiovascular, nervous, musculoskeletal systems have been identified. Signs of postural disturbances differed significantly in different age groups and there was an increase in pathology with increasing age of the child: in the 5–7-year-old age group discovered for 15.75% of children, in the 8–9-year-old age group – 41.67%, 10–14-year-old age group – 49.7%, 15–18-year-old age group – 68.2% respectively (Fig. 1).



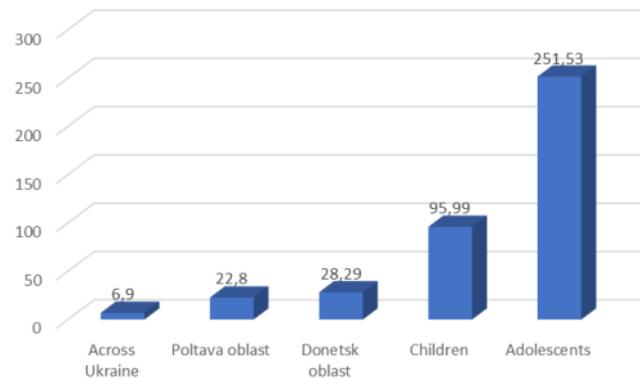
**Fig. 1. Detection of scoliosis and postural disturbances of children according to own research**

The obtained data confirm the growth of pathology in the older age category and among children living in the territory of hostilities. Clinical examples of rapid progression of scoliosis from grade I to grade III during one year were observed in adolescents from the ATO group and internally displaced persons (IDPs), the reasons for this process we consider occurred low protein intake, chronic stress, hypovitaminosis. Metabolic disturbances and changes in endocrine organs were revealed. Weight loss was found among 57.17% of boys and 25% of girls aged 5–8-year-old; at the age of 10–14-year-old for boys – 26.31%, for girls – 15.38% from the group of IDPs and arrived from the anti-terrorist operation zone.



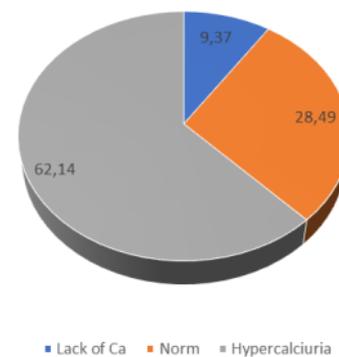
**Fig. 3. Level of calcium in the blood of children according to own research**

The same trend in the growth of scoliosis was revealed: in the 5–7-year-old age group it was discovered for 3.49% of children, in the 8–9-year-old age group – 13.78%, in the 10–14-year-old age group – 17.89%, in the 15–18-year-old age group – 25.15% of those surveyed in this age category (Fig. 1). According to the results of own research: I degree of severity of scoliosis was 54.1% of cases, II degree – 41.7%, III degree – 4.7% among "relatively healthy children". The prevalence of scoliosis among "conditionally healthy" children and adolescents according to own study (cases per 1000 children) is given below in comparison (Fig. 2).



**Fig. 2. Prevalence of scoliosis among children and adolescents**

The analysis of calcium levels in blood and urine was performed (Fig. 3; Fig. 4). Analyzing calcium metabolism, a decrease in blood calcium levels (below 2.1 mmol / l) was confirmed for 274 (18.61%) people in different age groups; an increase in blood calcium was discovered for 21 people (1.43%), the average value of calcium was 2.2 ± 0.8 mmol / l (Fig. 3). Hypercalciuria, according to the Sulkovich method was detected for 62.14% of observed. This is 2 times more than the number of children and adolescents with normal values and does not correspond to 1.43% of cases of hypercalcemia (Fig. 4). Thus, calcium loss by children and adolescents has been confirmed.



**Fig. 4. Loss of calcium through the kidney by children living in the anti-terrorist operation zone (ATO)**

Changes in the size of the thyroid gland were discovered in all age groups of children, with a higher rate for children – 31.72% and 29.03% for adolescents respectively from the ATO zone; in control groups: 11.78% for children, and 11.9% for adolescents. The more common phenomenon among girls is glandular hyperplasia, while hypoplasia among boys. Changes in the structure of the parathyroid glands were mini-

mal. An association between anxiety and heart rhythm disturbances has been established. This feature indicates the negative impact of anxiety on the cardiovascular system ( $r = 0.912$ ). According to the results of psychological research, an increase of different groups of fears was established, depending on the age and location in respect of the area of active hostilities. The results of the diagnosis of fears among children are shown in table 1.

**Table 1. Nature of fears among 5-7 and 10-14-year-old children living in the anti-terrorist operation zone**

Types of fears	Children 5–7 years, n = 671 [%]	Children 8–9 years, n = 264 [%]	Children 10-14 years, n = 408 [%]	Children 15–18 year, n = 124 [%]
Physical harm	68.92	62.57	46.32	54.13
Medical	58.37	34.12	22.14	17.81
Social	52.27	61.94	67.08	69.31
Fear of war	48.96	60.23	75.38	68.55
Fear of night	48.93	51.94	53.13	32.19
Spatial	39.44	37.12	19.66	16.94

For the first time, the predominance of fear of war among children being in a negative psycho-emotional state and in socially unfavorable conditions was noted. This type of fear is not typical for children.

Diagnosis of fears for IDP children is given in table 2.

The availability of fear of war and physical harm indicates the

negative experience of IDP children and the likelihood of psychotraumatic consequences among children as a result of military actions.

Adolescents have the most significant fears that threaten the physical integrity of the person or are associated with negative experiences and have an appearance in different gender groups (Table 3).

**Table 2. Nature of the fears of IDP children**

Types of fears	Children 5–14 years, n = 147	
	Children 5–7 years, n = 83 [%]	Children 10–14 years, n = 64 [%]
Physical harm	73.36	58.39
Medical	53.56	36.89
Social	58.96	47.22
Fear of war	73.18	55.53
Fear of night	41.15	69.31
Spatial	22.39	12.66

**Table 3. The results of a study the nature of fears among 10-14-year-old children depending on gender**

Become / kind of fear	Girls (n = 278)		Boys (n = 130)	
	Absolute	%	Absolute	%
Physical harm	174	62.77	66	51.12
Medical	190	68.23	51	39.63
Social	231	83.22	88	67.97
Fear of war	103	37.15	93	71.26
Fear of night	92	33.19	14	11.08
Spatial	33	12.05	25	19.31

The availability of several types of fears among children reduces their self-confidence without which adequate self-esteem, implementation of plans is impossible.

According to the Childhood Neurosis Questionnaire method,

a study of the emotional state of adolescents in the IDP category who are in the anti-terrorist operation zone was conducted. The results of the study are presented in tables 4 and 5.

**Table 4. The results of the study of neurosis-like states among 10-14-year-old children**

Indicator	children 10–14 years [points], n = 408
Depression	9.27 ± 0.03
Asthenia	8.45 ± 0.02
Behavioral disturbances	14.78 ± 0.07
Vegetative appearance	11.59 ± 0.06
Anxiety	14.03 ± 0.04
Sleep disturbances	11.34 ± 0.02

**Table 5. The results of the study of neurosis-like states among 10-14-year-old IDP category children**

Indicator	children 10–14 years [points], n = 194
Depression	11.03 ± 0.05
Asthenia	17.22 ± 0.04
Behavioral disturbances	15.38 ± 0.03
Vegetative appearance	18.89 ± 0.06
Anxiety	16.92 ± 0.05
Sleep disturbances	18.54 ± 0.04

Analysis of the results of the study, mentioned in table 5, showed that the rates of violations in the group of children who witnessed hostilities or lived in a situation of military conflict are higher, with dominated signs of vegetative appearance (18.89 ± 0.06), asthenia (17, 22 ± 0.04) and sleep disturbances (18.54 ± 0.04).

To determine the connection between the severity of neurosis-like conditions and the fear of war among children in the area of anti-terrorist operation, a correlation analysis of the data was performed (Table 6).

**Table 6. The results of a study of the correlation between the severity of neurosis and fear of war among 10-14-year-old children**

Indicator	Correlation coefficient
Depression	0.22
Asthenia	0.24
Behavioral disturbances	0.25
Vegetative appearance	0.34
Anxiety	0.43
Sleep disturbances	0.37

*Spearman's rank correlation coefficient  $r_s$  at  $p \leq 0.01$*

The results of the study (Table 6) showed that the vegetative appearances ( $r_s = 0.34$ ), ( $p \leq 0.01$ ), sleep disturbances ( $r_s = 0.43$ ), ( $p \leq 0.01$ ) and anxiety ( $r_s = 0.37$ ), ( $p \leq 0.01$ ) among children with a high degree of fear of war become stronger. Diagnosis of anxiety was performed in the age groups of

7-17-year-old children. Based on the results of the diagnosis, the connection between the level of anxiety and other scales of psychopathological symptoms of children who sought medical help was determined, and correlation analysis of the data was performed (Tables 7-10).

**Table 7. Dynamics of correlation between anxiety and depression**

Indexes	Anxiety	Depression	Correlation coefficient
Before treatment	14.23 ± 0.04	9.27 ± 0.124	0.582**
Post-treatment	9.55 ± 0.779	7.43 ± 0.879	0.776**

Significance of differences according to Pearson's criterion between the level of anxiety and depression during the rehabilitation period: \*\* $p \leq 0.01$

**Table 8. Dynamics of correlation between anxiety and asthenia**

Indexes	Anxiety	Depression	Correlation coefficient
Before treatment	14.23 ± 0.04	8.45 ± 0.15	0.849**
Post-treatment	9.55 ± 0.779	6.96 ± 0.535	0.710**

Significance of differences according to Pearson's criterion between the level of anxiety and asthenia during the rehabilitation period: \*\* $p \leq 0.01$

**Table 9. Dynamics of correlation between anxiety and autonomic disturbances**

Indexes	Anxiety	Depression	Correlation coefficient
Before treatment	14.23 ± 0.04	11.59 ± 0.210	0.677**
Post-treatment	9.55 ± 0.779	10.63 ± 0.737	0.588**

Significance of differences according to Pearson's criterion between the level of anxiety and autonomic disturbances during the rehabilitation period: \*\* $p \leq 0.01$

**Table 10. Dynamics of correlation between anxiety and sleep disturbances**

Indexes	Anxiety	Depression	Correlation coefficient
Before treatment	14.23 ± 0.04	13.65 ± 0.987	0.772**
Post-treatment	9.55 ± 0.779	9.736 ± 0.675	0.397**

Significance of differences according to Pearson's criterion between the level of anxiety and sleep disturbances during the rehabilitation period: \*\* $p \leq 0.01$

After the application of complex medical and psychological measures, there is a significant reduction of anxiety and asthenia ( $r_s = 0.500$ ), ( $p \leq 0.01$ ), autonomic disturbances ( $r_s = 0.591$ ), ( $p \leq 0.01$ ), sleep disturbances ( $r_s = 0.598$ ), ( $p \leq 0.01$ ), verbal aggression ( $r_s = 0.598$ ), ( $p \leq 0.01$ ), suspicion ( $r_s = 0.617$ ), ( $p \leq 0.01$ ).

### Conclusions

1. The growth of the spine pathology during the period of maximum growth intensity of the child is confirmed. Scoliosis occurred in the 5-7-year-old age group for 3.49% of children, in the 8-10-year-old age group for 13.78%, in the 10-14-year-old age group for 17.89%, in the 15-17-year-old age group for

25.15% respectively. An increase in the prevalence of scoliosis in the Donetsk oblast (excluding the temporarily occupied territories) at the level of 28.26 cases per 1,000 schoolchildren, which is more than in other regions of Ukraine. The similarity of the pathogenesis of scoliosis, stress, and hypercalciuria was determined, which explains the data obtained by us on the prevalence of scoliosis in the ATO area, actually 95.89 cases per 1000 children, and 251.53 cases per 1000 adolescents aged 15-18-year-old. The large difference between the prevalence rates indicates the influence of negative emotions and stress on the growth of pathology.

2. Fear of war is not typical for this age group of children. The results of the study showed that the children with a pronounced

fear of war have the appearance of autonomic disturbances ((rs = 0.34), (p ≤ 0.01)), sleep disturbances ((rs = 0.43), (p ≤ 0, 01)), anxiety ((rs = 0.43), (p ≤ 0.01)) and there is a decrease in performance after a course of medical and psychological rehabilitation.

3. The pathogenesis of scoliosis, stress, and hypercalciuria have similar components (involvement of endocrine organs). Military actions cause chronic stress formation in the child's body, changes in mental state, and functional changes in the somatic state. It is necessary to consider scoliosis as a stressor that can cause both pain and psychogenic stress. On the other hand, chronic stress stimulates the progression of scoliosis. Scoliosis correlates with a decrease in muscle mass, changes in the thyroid gland, the appearance of signs of stress.

4. Hypercalciuria was diagnosed in all age groups. It is 62.14% of all examined and is diagnosed among children with normal blood calcium levels and therefore is not aimed on support calcium homeostasis. Loss of calcium through the kidneys disrupts calcium metabolism in bone tissue and is one of the reasons for the progression of scoliosis in stressful conditions.

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