

ORIGINAL ARTICLE

ANXIETY DISORDERS IN CHILDREN SUFFERING FROM FUNCTIONAL AND ORGANIC RESPIRATORY DISORDERS

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ABSTRACT

The aim: To determine the anxiety disorders in children suffering from organic diseases and functional disorders of the respiratory tract in the clinical settings of the pulmonology department, as well as to assess their impact on disease course and quality of life.

Materials and methods: 131 pediatric patients aged 6–17 years old have been studied. The patients were divided into three groups: the children with somatoform respiratory disorders (SRD) – 33,6 % (n = 44), those with bronchial asthma (BA) – 34,3 % (n = 45) and those with pneumonia – 32,1 % (n = 42). Spielberger-Khanin test questionnaire was used to study anxiety, and Nijmegen questionnaire was used to diagnose hyperventilation syndrome (HVS). Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q) was used to determine the quality of life.

Results: Severe trait anxiety was observed more often in the subgroup of children with SRD (65,9 %) than in those with asthma (40,0 %) and pneumonia (21,5 %). HVS occurred in 19,1 % of patients. Direct moderate correlations were found between Spielberger scale (trait anxiety, $r = 0,426$; $p < 0,0001$), (state anxiety, $r = 0,393$; $p < 0,0001$) and Nijmegen HVS questionnaire, as well as inverse moderate correlations between Spielberger scale (state anxiety, $r = -0,321$; $p < 0,0001$), (trait anxiety, $r = -0,429$; $p < 0,0001$) and Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q).

Conclusions: Severe trait and state anxiety was found in 42,8 % and 19,1 % of children, respectively. Severe state and trait anxiety was observed more often in patients with SRD (65,9 % and 27,3 %, respectively), being twice as common in girls as in boys (57,6 % versus 32,1 % for trait anxiety and 24,8 % versus 12,6 % for state anxiety, respectively). Anxiety disorders are supposed to be the basis for HVS development and the cause of low satisfaction with the quality of life in patients with pulmonary diseases.

KEY WORDS: anxiety, organic lung diseases, functional disorders of the respiratory tract, quality of life, children

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INTRODUCTION

Anxiety disorders are one of the most common mental disorders in children and adolescents. Anxiety is characterized by unpleasant emotional experiences (e.g. uneasiness), cognitive (e.g. fear, helplessness), physiological (e.g. muscle tension) and behavioral (e.g. avoidance) changes [1].

In adolescence, anxiety disorders can be associated with significant functional impairment, significant decline in quality of life and higher levels of comorbidities [2].

Lifelong anxiety disorders are the only psychiatric disorders that are significantly associated with bronchial asthma (BA), with a possible bidirectional link, each of which may be caused by or be the consequence of another. Regression analysis has showed that the presence of lifelong anxiety disorder quadruples the risk of developing asthma, including the uncontrolled and severe one. Similarly, asthma makes the risk of anxiety disorder development higher than twice [3].

Bronchial asthma is one of the most common diseases included in the so-called Holyseven, i.e. childhood psychosomatosis. It is a classic example of a multifactorial disease pathogenetically caused by the interaction of numerous somatic and psychoemotional factors. The physiological characteristics of respiration are directly related to the

emotional state of a child, and this correlation persists all lifelong. Asthma in children is accompanied by severe anxiety reactions with a layering on the anxious personality causing emotional discomfort that increases with higher severity of the disease and decreases with a greater control of the disease [4].

Asthma is often described as a classic psychosomatic disorder that has got common features of pathophysiological and psychological ways with anxiety and depression [5].

Anxiety disorders, somatoform disorders and stress disorders are usually classified under the same heading. Their common denominator is anxiety. Anxiety is quite often transformed into a number of somatic symptoms that imitate the dysfunction of various organs and systems. Such somatic manifestations of anxiety are commonly called somatoform disorders (SD) [6].

Somatoform disorders are characterized by recurrence of subjective experiencing physical symptoms that are not explained by any physical disease. They are accompanied by significant distress and deterioration in life quality. As a rule, SD is diagnosed by excluding organic causes [7].

SD in children and adolescents can have negative effects on their development and life quality. Thus, this disorder requires more attention [8].

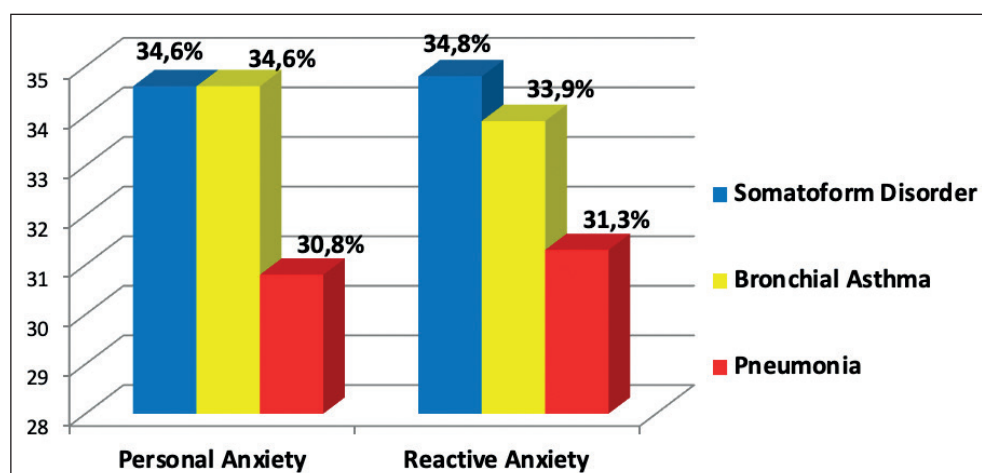


Fig. 1. Structure of anxiety in children with lung disease

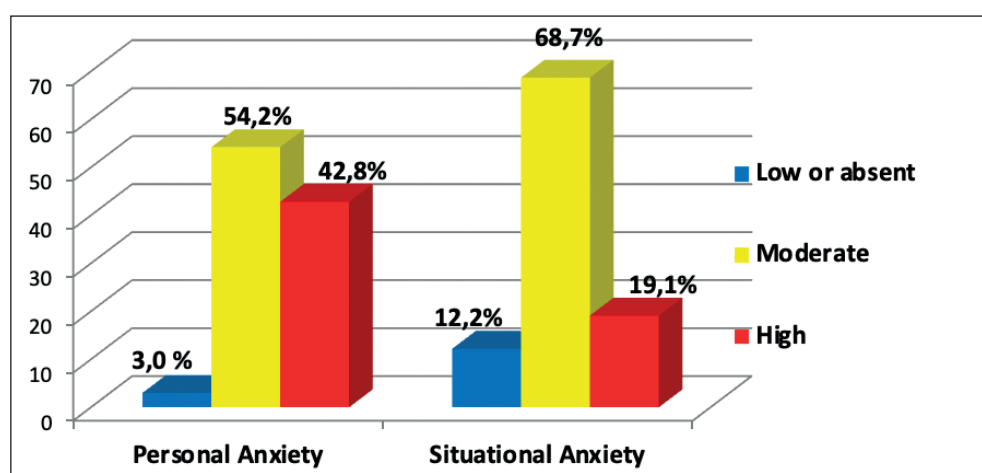


Fig. 2. Severity of anxiety in children with respiratory diseases

Furthermore, early diagnostics of anxiety disorders in children is important because most cases remain untreated. It causes suffering and hinders their social functioning [1].

THE AIM

The objective of the study is to identify the anxiety disorders in sick children suffering from organic and functional lung pathologies at the pulmonology department and to assess their impact on the course of the disease and patients' life quality.

MATERIALS AND METHODS

Having signed the informed consent of the parents and children, 131 patients aged 6-17 years old were involved in the study. 54,9 % counted boys ($n = 72$), and 45,1 % counted girls ($n = 59$). The children were divided into three groups. The first one included the patients suffering from asthma – 34,3 % ($n = 45$), the second one included those with SD from the respiratory system – 33,6% ($n = 44$), and the third group contained the patients suffering from pneumonia – 32,1 % ($n = 42$).

The selection of children and the diagnosis of SD were performed after their general clinical examination and according to the criteria of SD ICD-10. To study anxiety

we used Spielberger's test (STAI - State - Trait Anxiety Inventory) modified by Yu. L. Khanin. It helped us detect the level of reactive and personal anxiety. The indicators are interpreted as the following: the anxiety is low up to 30 points, it is moderate according to 31- 44 points, and it is high according to 45 points and higher [9]. The Nijmegen Questionnaire (Nijmegen Questionnaire) was used to diagnose HVS as the main manifestation of SD. The sum of points according to the Nijmegen questionnaire > 23 has a sensitivity of 91 % and a specificity of 95 % for the diagnosis of HVS [10]. To determine life quality of the patients suffering from respiratory diseases and comorbidities Pediatric Quality of Life Enjoyment and Satisfaction Questionnaire (PQ-LES-Q) was used. The questionnaire was developed by Jean Endicott to assess the degree of satisfaction in various spheres of life of children aged 6-17 years old [11].

Statistical analysis was performed using the software package Statistica 8.0.360, MedCalc.7.4.4.1 and Excel (2007). The quantitative characteristics are given in the form of $M \pm \sigma$. The validity of differences was assessed using Student's two-sample t-test and constructing a 95% confidence interval (CI) for the difference between the means, as well as employing methods of correlation and regression analysis. The values at $p < 0,05$ were considered reliable.

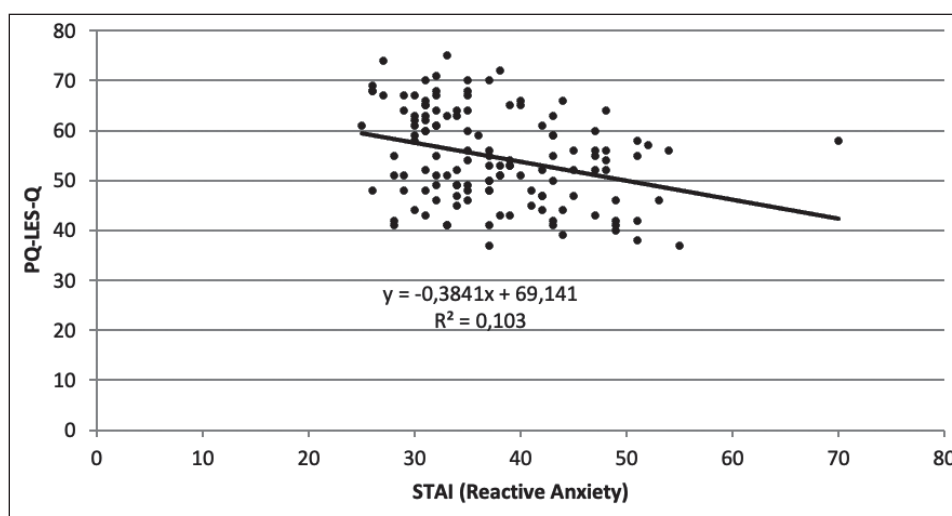


Fig. 3. Interrelationship between reactive anxiety according to the STAI scale and quality of life satisfaction according to the PQ-LES-Q questionnaire.

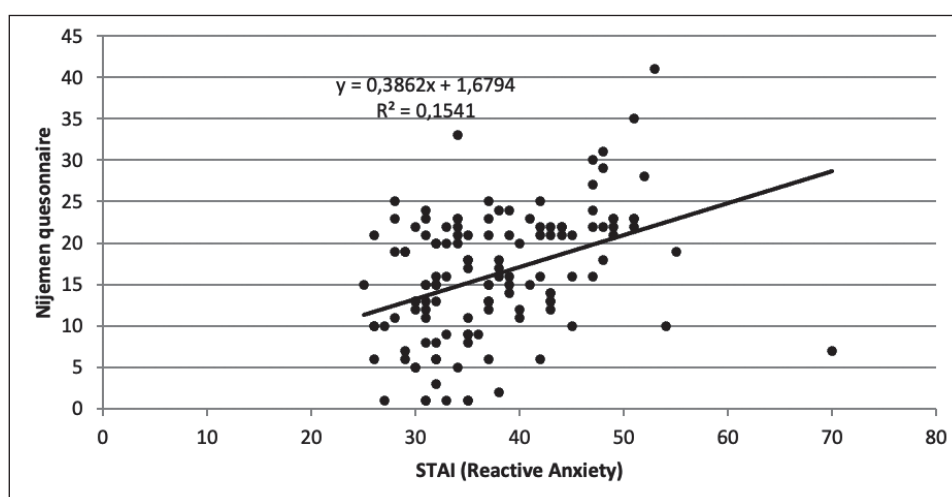


Fig. 4. Interrelationship between personal anxiety on the STAI scale and quality of life satisfaction according to the PQ-LES-Q questionnaire.

RESULTS

The conducted study on the anxiety symptoms in children, both in general and in separate groups, has shown a high frequency of both personal and reactive anxiety.

The study of the entire cohort of children ($n = 131$) has revealed moderate or severe personal anxiety in 127 (96,9 %) patients, and reactive anxiety in 115 (87,7 %) ones.

The main structure of the personal anxiety numbered 44 (34,6 %) children suffering from functional respiratory disorders who met the criteria of SD; 44 (34,6 %) children with asthma, and 39 (30,8 %) children with pneumonia. Reactive anxiety was found in 40 (34,8 %) children with SD, in 39 (33,9 %) children with asthma and in 36 (31,3 %) children with pneumonia (Fig. 1).

The severity is an important indicator of anxiety. Thus, in the general structure of personal anxiety, the mild or no anxiety was determined in 4 (3,0 %) sick children, the moderate one was seen in 71 (54,2 %) sick children, and the severe anxiety was observed in 56 (42,8 %) children. In the general structure of the reactive anxiety a mild degree of anxiety or its absence was determined in 16 (12,2 %) sick children, the moderate one - in 90 (68,7 %) sick children, and the severe one - in 25 (19,1 %) children (Fig. 2).

The severity of both personal and reactive anxiety varied significantly depending on the pathology. The highest number of severe personal anxiety was observed in the subgroup with SD in 29 (65,9 %) children, slightly less in the subgroup with asthma, i.e. in 18 (40,0 %) children, and the lowest number was observed in the subgroup with pneumonia, i.e. in 9 (21,5 %) children. Similarly, the highest number of severe reactive anxiety was also observed in the subgroup with SD, i.e. in 12 (27,3 %) children, slightly less was observed in the subgroup with asthma, i.e. in 11 (24,4 %) children and the lowest number was observed in the subgroup with pneumonia, i.e. in 2 (4,8 %) children.

According to the questionnaire the largest number of children with severe personal anxiety occurred at the age period from 15 to 17 (19 out of 36 people, which accounted 52,7 %). Less frequently severe personal anxiety occurred at the age period from 11 to 14 (in 19 out of 47 children, which was 40,5 %), and the lowest frequency was observed in children aged 6-10 years old (in 17 children out of 48, which equaled 35,4 %). At the same time, the largest number of children with the severe reactive anxiety occurred at the age period from 11 to 14 years old (14 out of 47 people, which equaled 29,9 %). Slightly lower incidence of the severe reactive anxiety occurred at the age period from 6 to 10 years old (in 7 out of 48 children,

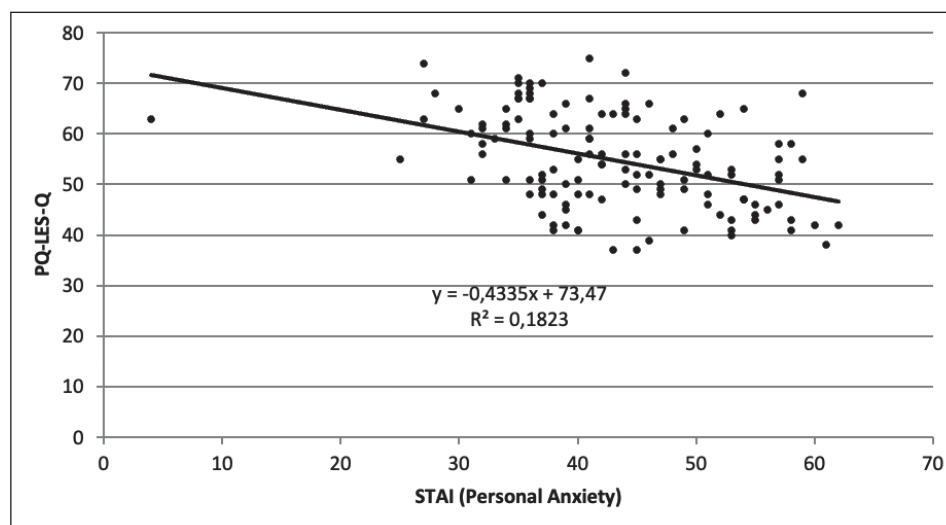


Fig. 5. Interrelationship between personal anxiety on the STAI scale and according to the Nijmegen HVS questionnaire.

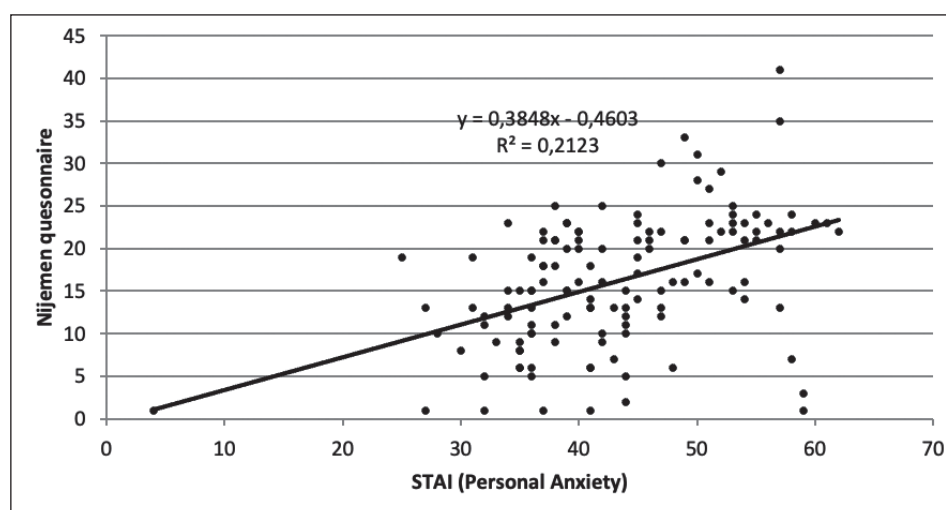


Fig. 6. The interrelationship between reactive anxiety results according to the STAI scale and according to the Nijmegen HVS questionnaire.

which was 14,7 %), and the least common in children aged 15-17 years old (in 5 children out of 36, which was 13,9 %).

Low levels of both personal and reactive anxiety, or its absence, were almost three times more common in boys than in girls (4,1 % vs. 1,7 % for personal anxiety, and 16,6 % vs. 5,0 % for reactive anxiety respectively). Severe levels of both personal and reactive anxiety were almost twice as common in girls as in boys (57,6 % vs. 32,1 % for personal anxiety, and 24,8 % vs. 12,6 % for reactive anxiety respectively).

The children suffering from the personal anxiety, the highest score on the Spielberger-Khanin scale was determined in the children with SD, much lower it was observed in the children with asthma, and the lowest one was found in the patients with pneumonia. The children with SD might demonstrate higher levels of the personal anxiety due to the presence of the pathology in its basis with somatic manifestations in the form of HVS and the comorbid development of depression or vice versa. Thus, the sick children with SD demonstrate the number of points according to the Spielberger-Khanin scale $47,3 \pm 8,3$, which significantly exceeded the number of points for the group of children with asthma, i.e. $43,9 \pm 7,8$ (95% CI: 0,01 – 6,8; $p < 0,05$), and for the group of children with

pneumonia, whose total score was $38,4 \pm 9,3$ (95 % CI: 5,1 – 12,7; $p < 0,0001$). The number of points in the group of children with asthma also significantly exceeded the level in the group of children with pneumonia (95 % CI: 1,8 – 9,1; $p < 0,003$).

Among the children suffering from the reactive anxiety, the highest score on the Spielberger-Khanin scale was determined for the children with asthma, slightly lower for the children with SD, and the lowest one was for the patients with pneumonia. The highest score of the reactive anxiety is expected in the group of patients with asthma, because the presence of background anxiety in combination with organic lung disease, accompanied by asthma attacks, can cause a significant increase in the exacerbation of the pathology. Similar changes can be observed in patients with SD, especially in the crisis course of HVS, which is accompanied by a significant feeling of shortness of breath. Thus, the number of points in the group of patients with asthma according to the Spielberger-Khanin scale was $39,1 \pm 8,7$, and it significantly exceeded the number of points in the group of children with pneumonia, which was $34,1 \pm 5,8$ (95 % CI: 1,8 – 8,2, $p < 0,002$), and it was slightly different from the number of points in the group of children

with SD – $38,4 \pm 9,2$ ($p > 0,05$). The number of points in the group children with SD also significantly exceeded its level in the group of children with pneumonia (95 % CI: 1,0 – 7,6; $p < 0,001$).

Applying the Nijmegen questionnaire for 131 patients with respiratory disorders, 25 (19,1 %) children were diagnosed with hyperventilation syndrome (HVS). Its basic structure constituted 17 (68 %) children with SD, 5 (20 %) children with asthma and 3 (12 %) children with pneumonia. The combination of organic pathology and dysfunction of the respiratory tract in children has been observed in many studies, which must be considered for the management of such patients, since the presence of HVS or any other dysfunctional disorders can worsen the course of organic disease and mislead the doctor about the ineffectiveness of the treatment.

The children having HVS, the highest score according to the Nijmegen questionnaire was determined in the children with asthma, the children with pneumonia had slightly lower scores, and the patients with SD had the lowest ones. Probably, such a difference in manifestation may be due to the existing premorbid psycho-emotional background and autonomic dysregulation in the children with organic lung diseases. Occurring in the period of organic disease these factors lead to decompensation of autonomic regulation of the respiratory system, which come in combination with pathophysiological disorders due to the underlying disease and emotional stress, that may increase during the disease, and lead to increased shortness of breath and, thus, increased HVS. Thus, in the group of patients with asthma the number of points according to the Nijmegen questionnaire was $31,2 \pm 3,0$, which significantly exceeded the number of points in the group of children with respiratory tract SD, which was $24,1 \pm 1,8$ (95 % CI: 4,9 – 9,3, $p < 0,0001$). Also, in the group of patients with pneumonia, the number of points was $29,7 \pm 9,8$, and it significantly exceeded the number of points in the group of children with SD (95 % CI: 0,7 – 10,4; $p < 0,02$). The patients with asthma and the ones with pneumonia had no significant difference in the questionnaire results.

Having applied the pediatric quality of life questionnaire PQ-LES-Q, the lowest score was observed in the group of children with SD, significantly higher scores were noted in the group of sick children with organic lung disease (asthma and pneumonia). Thus, the total score on the PQ-LES-Q scale in the group of children with SD was $47,5 \pm 6,6$, and it was significantly lower than the overall score in the group of children with asthma, which was $57,5 \pm 13,9$ (95% CI: 5,4 – 14,6; $p < 0,0001$), and in the group of children with pneumonia, whose total score was $56,9 \pm 8,4$ (95 % CI: 6,2 – 12,6; $p < 0,0001$). There was no significant difference in scores between children with asthma and pneumonia.

Taking into account the obtained data, it is possible to suppose a certain link between the presence and severity of anxiety and the development of HVS. Also, it is presumable that the decline in life quality of the children with functional and organic lung diseases may be due not only to the underlying disease, but also to the emergence of both

primary and secondary anxiety symptoms, associated with the underlying pathology. We used correlation and regression analyzes to establish this interrelationship.

The analysis of the diagram showed the peculiarities of the link between the growth of reactive anxiety and the life quality of the patients with pulmonary pathology (Fig. 3).

The calculated correlation coefficient r is $-0,321$ ($p < 0,0001$). Thus, reliable feedback and moderate correlation were found according to the Chaddock scale, i.e. with the increased scores on the STAI scale (reactive anxiety), the score on the PQ-LES-Q scale decreases, which may indicate the role of the reactive anxiety in reducing life quality of the patients with the pulmonary pathology.

A similar significant feedback and moderate correlation was found between the personal anxiety on the STAI scale and according to the PQ-LES-Q questionnaire. The calculated correlation coefficient r was $-0,429$ ($p < 0,0001$) (Fig. 4).

The analysis of the diagram showed certain features of the interrelationship between the growth of personal anxiety symptoms and the occurrence of HVS (Fig. 5).

The calculated correlation coefficient r is $0,426$ ($p < 0,0001$). Thus, a reliable direct and moderate correlation was found on the Chaddock scale between the values on the STAI scale (personal anxiety) and according to the Nijmegen Questionnaire HVS, i.e. with the increasing scores on the STAI scale (personal anxiety), the score on the Nijmegen Questionnaire increases too. It may indicate the role of the anxiety symptoms in the development of HVS.

A similar reliable direct and moderate correlation was found between the reactive anxiety results according to the STAI and according to the PQ-LES-Q questionnaire. The calculated correlation coefficient r was $0,393$ ($p < 0,0001$) (Fig. 6).

DISCUSSION

Anxiety is an individual psychological feature that is an increased tendency to feel anxious in a variety of life situations. There are two types of anxiety, i.e. situational, or reactive, and personal. The reactive anxiety is an indicator of the intensity of experiences that occur in relation to typical events and is characterized by tension, anxiety, nervousness. The personal anxiety is a person's readiness (attitude) to experience fear and anxiety about a wide range of subjectively significant phenomena. The personal anxiety is a persistent condition. It characterizes a person's tendency to perceive a wide range of situations as threatening, to respond to such situations with anxiety [12].

In our study, almost every second examined child suffering from organic diseases and functional disorders of the respiratory tract has significant anxiety disorders, both personal and reactive, which may be a factor in the predisposition to comorbid depression, as well as its somatic manifestation (e.g. HVS) can worsen the course of the disease and the duration of rehabilitation. The obtained data indicate a significant prevalence of anxiety disorders in children with various pathologies of the respiratory tract, which may be a premorbid background; they may further

cause psychosomatic spectrum disorders, depression and predisposition to some somatic pathology. Similar trends were demonstrated in the study of L.V. Pypa et al. (2019), which revealed a high incidence of anxiety disorders, especially in adolescents who had a premorbid background and the social component of their occurrence (incomplete family, bad habits) [13].

In the structure of SD the anxiety can form the basis of the pathology itself and be determined at the primary level. But in the structure of the organic diseases anxiety can be comorbid pathology as a reaction to the development of the underlying disease, especially it concerns the reactive anxiety. However, it is possible that the personal anxiety in the patients with organic lung disease may have been present as a characteristic feature before the development of organic disease, and on the basis of which functional somatic disorders, including HVS, may occur simultaneously with the development of organic disease. Thus, the study by S.R. Del Giacco et al. (2016), demonstrated a significant association between bronchial asthma and anxiety disorders (OR 3,03; $p < 0,003$); no significant association with another psychiatric diagnosis was found. In addition, anxiety was associated with the severity of asthma ($p < 0,001$). Asthma preceded anxiety in 48 % of cases, and in 52 % of cases anxiety preceded asthma [3].

According to T. Derazl et al. (2018), 34,4 % of the children with asthma had increased anxiety, and 33,3 % of the children had depression. Moreover, severe asthma, uncontrolled asthma and concomitant depression were independent risk factors for anxiety in the children with asthma [5].

The highest incidence of the severe, both personal and reactive, anxiety in the patients with SD, in comparison to other pulmonary pathologies, confirms its main component of the premorbid background, which further leads to psychosomatic spectrum diseases, as well as its role in clinical manifestations of HVS. The lowest incidence of the severe anxiety was observed in the patients with pneumonia, where functional respiratory disorders are much less common during the disease, and which contribute much less to the clinical symptoms of the disease, in comparison to the patients with asthma, where the main clinical symptoms are more often accompanied by the psychosomatic spectrum disorders, worsening the course of the disease and rehabilitation.

The predominance of the severe reactive anxiety at the age from 11 to 14 years old may be due to unstable emotional background, which occurs during puberty, which can lead to increased sensitivity to various stressors with the development, in response, anxious symptoms, including the background of organic lung disease. Completion of the formation of anxious personality occurs during the completion of puberty and the transition to adulthood, which, accordingly, determines the largest number of children with severe personal anxiety in the period between 15 to 17 years old.

Severe both personal and reactive anxiety were almost twice as common in girls as in boys. Relevant results may

suggest that the female gender may be a risk factor for the development of anxiety disorders and related psychosomatic disorders, including HVS in the structure of SD and organic lung diseases.

Such dysfunctional respiratory disorders as HVS have been reported in all pulmonary pathologies, including asthma and pneumonia. However, the largest number of them occurred in the SR, which determines their affiliation to psychosomatic disorders as a somatic component of the anxiety. The dysfunctional respiratory disorders in the patients with organic diseases of the respiratory tract indicate the development of anxiety and depressive disorders in response to the underlying pathology or their existence before the development of organic disease. The premorbid psycho-emotional background and decompensation of autonomic respiratory dysregulation also contribute to the occurrence of HVS. In combination with pathophysiological disorders due to the underlying disease and emotional stress it leads to the increased shortness of breath.

According to the PQ-LES-Q scale, the lowest quality of life satisfaction was observed in the group of children with SD in comparison with other pulmonary pathologies. It is most likely that anxiety and depressive disorders, which are most revealed in this category of the patients and are the main symptoms of the disease, may play a significant role in low level of the life quality satisfaction of the sick children with SD in comparison with the patients suffering from organic diseases of the respiratory system. Thus, it is possible to suppose the existence of the primary relation of the life quality satisfaction of the child with the psycho-emotional state rather than with the organic disease, which requires further research.

CONCLUSIONS

Among the children suffering from respiratory diseases, severe personal and reactive types of anxiety were observed in 42,8 % and 19,1 % respectively, being significantly predominant in the children with SD, i.e. the personal anxiety was found in 65,9 % of the children, the reactive one was in 27,3 % respectively). Severe both personal and reactive types of anxiety were almost twice as common in girls as in boys (57,6 % vs. 32,1 % for the personal anxiety, and 24,8 % vs. 12,6 % for the reactive anxiety respectively).

The HVS occurs in 19,1 % of pediatric patients having airway pathology. The anxiety premorbid background may be the cause of HVS, and its clinical manifestations may be a somatic one of anxiety, as evidenced by the existing direct and moderate correlations between the STAI scale (personal anxiety, $r = 0,426$; $p < 0,0001$), (reactive anxiety, $r = 0,393$; $p < 0,0001$) and the Nijmegen HVS questionnaire.

The reason of the low life quality satisfaction of the children suffering from respiratory diseases may be anxiety disorders, as evidenced by the available inverse and moderate correlations between the STAI scale (reactive anxiety, $r = -0,321$; $p < 0,0001$), (personal anxiety, $r = -0,429$; $p < 0,0001$) and the PQ-LES-Q.

To optimize the ways of treatment of pulmonary pathologies in children, it is necessary to consider not only

the main mechanisms of disease development but also the psycho-emotional state of the patient. Early detection of emotional disorders, especially anxiety and depression, can increase the effectiveness of treatment, improve the course of the disease and social adaptation, and reduce the frequency of relapses, especially in children suffering from asthma.

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Conflict of interest:

The Authors declare no conflict of interest.

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