GMR

The Original

Cognitive Disorders and Psychoemotional Maladaptation In Children with Bronchial Asthma

Aziza Djurabekova , Farrukh Samatov,

Doctor of Medical Sciences, Professor, Head of the Department of Neurology, Samarkand State Medical University
16 Abdulla Soni Street, Samarkand 140103, Uzbekistan E-mail: aziza508@mail.ru ORCID: https://orcid.org/0000-0001-6397-9576
Samarkand Medical University, Uzbekistan e-mail: farrux-samatov@bk.ru, https://orcid.org/0009-0000-3940-8976

ABSTRACT

The study included 118 children aged 5–12 years (mean age 7–9 years) with a verified diagnosis of moderate bronchial asthma in the remission phase. All patients were divided into three groups according to disease severity: Group I (mild form) – 47 children, Group II (moderate form) – 41 children, and Group III (severe form) – 30 children. Children with bronchial asthma demonstrated a progressive deterioration of cognitive functions, decreased self-esteem, increasing autonomic dysfunction, significant sleep disturbances, and high levels of anxiety and depression with increasing asthma severity. The obtained data highlight the need for comprehensive neuropsychological and psychosomatic screening, as well as the development of psychological support and correction programs within a multidisciplinary approach to the management of children with bronchial asthma.

Keywords: *Bronchial asthma, childhood, cognitive and psychoemotional disorders.*

INTRODUCTION

Bronchial asthma (BA) is a chronic and heterogeneous disease manifested by episodes of wheezing, coughing (often at night or during physical exertion), a sensation of chest tightness, and reversible bronchial obstruction accompanied by bronchial hyperreactivity (3,5). In most patients, the disease begins in childhood and often persists into adulthood, which underscores the importance of early diagnosis and prevention (8,9). The prevalence of asthma in Uzbekistan is approximately 10.0% and shows a tendency toward an increase in both overall and primary morbidity (1,2).

Bronchial asthma is one of the most common chronic diseases among school-aged children, exerting a significant impact on quality of life and placing a considerable burden on healthcare systems. According to data from the Global Burden of Disease study, the prevalence of BA in the 5–9-year age group in 2019 was 876.0 cases per 100,000 population (95% UI 599.7–1212.3), with a slight decrease in incidence of 5.3% over the period from 1990 to 2019 (95% UI 2.6–8.8) (3,4,9). In addition to respiratory symptoms, children with BA often exhibit disorders of the nervous system. In this context, neurocognitive disorders are understood as a decline in core cognitive functions (attention, memory, executive functions, and processing speed), which may be associated with chronic hypoxia, long-term therapy (especially the use of systemic glucocorticosteroids), and concomitant anxiety levels (7,8). Chronic hypoxia resulting from frequent asthma exacerbations can lead to neurometabolic changes in brain structures responsible for cognitive processes. Moreover, emotional stress related to restrictions in physical activity and fear of asthma attacks may further increase the risk of developing cognitive deficits (4,7). A child's social functioning is a complex indicator that includes communication skills, the ability to adapt within a peer group, and overall quality of

life. For school-aged children, any cognitive impairment inevitably affects academic performance, peer relationships, and self-esteem. In asthma, frequent school absences, limitations on physical activity, and the need for regular medication intake may lead to social isolation, reduced participation in group activities, and the development of anxiety disorders. As a result, not only the educational process but also socialization is disrupted, which subsequently affects psychological development (4,8). Despite the existence of individual studies addressing the cognitive and psychological consequences of chronic respiratory diseases in children, insufficient attention is paid in domestic pediatric practice to a comprehensive assessment of neurocognitive status and social functioning specifically in children with BA (7,8,9). Literature data indicate that cognitive deficits and reduced quality of life are more often identified in children with severe and poorly controlled asthma; however, detailed regional studies considering the specific characteristics of the Uzbek population, as well as the relationship between asthma severity and the extent of cognitive and social impairments, are lacking (3,4). Thus, the present study is aimed at identifying clinically significant features of neurocognitive disorders and social functioning in children with BA, which will substantiate the need for targeted screening measures and the development of recommendations for the correction of identified disorders. Aim of the study. To investigate the characteristics of neurocognitive disorders and social functioning in children with bronchial asthma. Materials and methods. A total of 118 older children aged 5–12 years (WHO classification of childhood age, 2021) with moderate bronchial asthma in the remission period were examined. In all cases, the diagnosis of BA was verified in accordance with the criteria of the international clinical guidelines PRACTALL & ICONs [2], based on anamnestic, clinical, functional, and laboratory data. The study was conducted in the pediatric department of the Surkhandarya Regional Hospital (2022–2024) and in the pediatric department of the multidisciplinary clinic of Samarkand State Medical University (2022–2024).

Table 1.Distribution of patients by groups according to the severity of bronchial asthma

Category	Group A (Number)	Group A (%)	Group B (Number)	Group B (%)	Group C (Number)	Group C (%)	Total (Number)	Total (%)	Notes
Preliminary Subtotal	16	–	11	–	5	–	32	–	Initial quantitative distribution before percentage calculation; reflects raw subgroup size
Primary Analytical Group	24	51.1 %	20	48.8 %	18	60.0 %	62	52.5%	Core group used for principal statistical analysis and interpretation
Secondary Analytical Group	7	14.9 %	10	24.4 %	7	23.3 %	24	20.3%	Complementary group providing comparative and supporting

									analytical data
Overall Total	47	39.8 %	41	34.7 %	30	25.4 %	118	100.0 %	Final aggregated sample representing the full study population

All patients were divided into three clinical groups depending on disease severity (Table 1):

Group I (mild form) – 47 children (100% of the group);

Group II (moderate form) – 41 children (100% of the group);

Group III (severe form) – 30 children (100% of the group).

The largest proportion of the sample consisted of children aged 7–9 years – 52.5% (62 children). The younger subgroup (5–6 years) included 27.1% (32 children), while the older subgroup (10–12 years) accounted for 20.3% (24 children).

- Among children aged 5–6 years, the mild form predominated (34.0% of this age subgroup), whereas moderate and severe forms accounted for 26.8% and 16.7%, respectively.
- In the 7–9-year age group, the mild form was also most frequently identified (51.1%); at the same time, the proportion of children with moderate disease was 48.8%, and those with severe disease accounted for 60.0% of all severe cases.
- Among adolescents aged 10–12 years, mild forms accounted for 14.9%, moderate forms for 24.4%, and severe forms for 23.3%. Despite the relatively high proportion of severe disease in the 10–12-year age group (within this specific age subgroup), the absolute number of severe cases in this subgroup was lower than in the 7–9-year group.

Among all 118 children, boys predominated – 60.2% (71 children), whereas girls accounted for 39.8% (47 children). A similar trend was observed in all three severity groups (Table 1): in the mild form (Group I), 59.6% were boys and 40.4% were girls; in the moderate form (Group II), 61.0% were boys and 39.0% were girls; and in the severe form (Group III), 60.0% were boys and 40.0% were girls.

Thus, the most numerous age subgroup was 7–9 years, in which both mild (Group I) and severe (Group III) forms of bronchial asthma were more frequently observed than in other age groups. In all severity groups, boys predominated, which is consistent with some literature data indicating a higher prevalence of bronchial asthma among boys of younger age. Children aged 5–6 and 7–9 years together constituted the majority of the sample: mild forms predominated among 5–6-year-olds, whereas the most severe forms were most often observed among children aged 7–9 years.

These results suggest that male sex and age 7–9 years may be risk factors for a more severe course of the disease; however, a more detailed analysis is required to clarify the underlying causes (e.g., taking into account heredity, immune status, social conditions, etc.).

All patients underwent comprehensive clinical and neurological examinations. The following assessment methods were also applied: cognitive functions (Wechsler Intelligence Test); self-esteem (Rosenberg Self-Esteem Scale); autonomic function (Autonomic Dysfunction Scale, cardiointervalography – SDNN, cortisol level); sleep quality (PSQI, overnight EEG monitoring – arousal index); affective disorders (Spence

Children's Anxiety Scale – SCAS, Children's Depression Inventory – CDI). Statistical methods were used for data analysis.

Study Results. To assess neurocognitive impairments in children with bronchial asthma, the Wechsler Intelligence Test and the Rosenberg Self-Esteem Scale (SES) were used. The test results in the three patient groups are presented in the table. Intellectual abilities assessed by the Wechsler method demonstrated a progressive decline with increasing severity of bronchial asthma. The mean score in the group with mild asthma was 92.3 ± 8.4, whereas in patients with moderate disease it was 87.1 ± 9.2 ($p = 0.031$), and in children with severe asthma it was even lower – 81.5 ± 10.1 ($p = 0.009$) (Table 2). These findings confirm the negative impact of hypoxia and chronic inflammation on cognitive functions. The deterioration in Wechsler test scores, especially in children with severe asthma, can be explained by prolonged intermittent hypoxia affecting neuroplasticity processes and functional brain activity.

Self-esteem scores measured using the Rosenberg Scale also decreased as disease severity increased. Mean values were 27.5 ± 3.2 in children with mild asthma, 24.8 ± 3.8 in patients with moderate disease ($p = 0.026$), and 22.1 ± 4.1 in children with severe asthma ($p = 0.007$) (Table 2). This indicates more pronounced psycho-emotional disturbances in children with severe asthma.

The study results demonstrate statistically significant differences ($p < 0.05$) between the groups for both indicators, confirming the negative impact of bronchial asthma severity on the cognitive and emotional development of children.

Table 2. Comparative results of the test according to the methodology By the D. Wechsler method and the Rosenberg Self-Esteem Scale (SES) in points

Group	Wechsler Test (M ± SD)	p-value (Wechsler Test)	Intergroup Comparison	Rosenberg Scale (M ± SD)	p-value (Rosenberg Scale)	Intergroup Comparison
I (Mild BA)	92.3 ± 8.4	0.045	I–II	27.5 ± 3.2	0.038	I–II
II (Moderate BA)	87.1 ± 9.2	0.031	II–III	24.8 ± 3.8	0.026	II–III
III (Severe BA)	81.5 ± 10.1	0.009	III–I	22.1 ± 4.1	0.007	III–I

Note here and below: p – significance level between groups; the groups are indicated in the adjacent column.

To assess the autonomic nervous system (ANS) status in children with bronchial asthma of varying severity, the Autonomic Dysfunction Scale (ADS), cardiointervalography (CIG, SDNN), and cortisol level assessment (morning and evening) were used as markers of stress activity of the hypothalamic-pituitary-adrenal (HPA) axis (Table 3).

Table 3. Indicators of autonomic dysfunction in children with bronchial asthma

Group Comparison	p-value (HRV Index)	p-value (CIG–SDNN)	Statistical Interpretation
I–II	0.042	0.039	Statistically significant difference
II–III	0.028	0.024	Statistically significant difference
III–I	0.011	0.008	Statistically significant difference

The mean score on the Autonomic Dysfunction Scale (ADS) significantly increased with the severity of bronchial asthma ($p = 0.011$). In the mild asthma group, the mean score was 18.5 ± 4.2; in Group II (moderate asthma) – 22.1 ± 5.1 ($p = 0.028$); and in patients with severe asthma – 26.7 ± 5.8 ($p = 0.011$).

Children with severe asthma exhibited pronounced autonomic dysfunctions, including sympathetic hyperactivity (tachycardia, sweating, labile blood pressure) and parasympathetic disorders (dizziness, hypotension, weakness). This confirms the impact of hypoxia and systemic inflammation on autonomic regulation, which is consistent with previous studies (Martinez et al., 2021)

Cardiointervalography allows assessment of the balance between sympathetic and parasympathetic activity of the ANS. The mean SDNN value (overall heart rate variability, ms) also showed a statistically significant decrease with increasing asthma severity ($p = 0.008$):

Group I (mild asthma): 54.2 ± 12.3 ms

Group II (moderate asthma): 48.6 ± 11.5 ms ($p = 0.024$)

Group III (severe asthma): 42.1 ± 10.9 ms ($p = 0.008$)

The reduction in SDNN in patients with severe asthma indicates an imbalance in autonomic regulation, with predominance of sympathetic activity and reduced compensatory capacity of the parasympathetic nervous system. This correlates with increased stress sensitivity and a tendency toward bronchial hyperreactivity. These findings align with Zhou et al. (2020), who reported that low SDNN values are associated with more severe asthma and an increased risk of cardiovascular complications.

Table 4. Morning and evening cortisol levels in children with bronchial asthma

Group Comparison	p-value (Morning Cortisol)	p-value (Evening Cortisol)	Statistical Interpretation
I–II	0.036	0.040	Statistically significant difference
II–III	0.029	0.033	Statistically significant difference
III–I	0.007	0.009	Statistically significant difference

Cortisol is a key hormone of the hypothalamic-pituitary-adrenal (HPA) axis that responds to stress and inflammatory processes. Cortisol levels, as a primary indicator of HPA axis activity, progressively increased with the severity of bronchial asthma ($p < 0.05$), confirming the impact of chronic inflammation and stress on endocrine regulation. Morning cortisol was significantly higher in children with severe asthma, reflecting hyperactivation of the stress system (Table 4). Elevated levels are associated with prolonged inflammation, hypoxia, and autonomic dysfunction, which is consistent with literature data (Wang et al., 2019).

The results confirm that autonomic dysfunction is more pronounced in children with severe bronchial asthma. This is manifested by:

marked disturbances in autonomic nervous system (ANS) regulation, reflected in increased ADS scores and decreased SDNN;

hyperactivation of the HPA axis, demonstrated by elevated cortisol levels;

reduced adaptive mechanisms, making these patients more vulnerable to stress and worsening the course of asthma.

To assess affective disorders in children with bronchial asthma, the Spence Children's Anxiety Scale (SCAS) and the Children's Depression Inventory (CDI) were used. The study results are presented in Table 6. The SCAS evaluates anxiety levels in children, including generalized anxiety, social fears, panic attacks, and obsessive-compulsive symptoms.

Mean SCAS scores in the groups were:

Group I (mild asthma): 22.1 ± 4.5

Group II (moderate asthma): 28.6 ± 5.3 ($p = 0.028$)

Group III (severe asthma): 35.2 ± 6.1 ($p = 0.009$)

In children with mild asthma, anxiety levels were within the moderate normal range. In the moderate asthma group, a significant increase in anxiety was observed ($p = 0.028$), indicating heightened stress reactivity. In children with severe asthma, anxiety was markedly pronounced ($p = 0.009$), reflecting profound anxiety disorders associated with respiratory disturbances, hypoxia, and psychological distress.

Table 6. Comparative indicators of anxiety and depression in children with bronchial asthma

Group Comparison	p-value (SCAS)	p-value (CDI)	Statistical Interpretation
I–II	0.041	0.038	Statistically significant difference
II–III	0.028	0.026	Statistically significant difference
III–I	0.009	0.007	Statistically significant difference

Main causes of increased anxiety with the severity of bronchial asthma (BA):

Fear of suffocation and asthma attacks → leads to generalized anxiety and panic attacks. Frequent hospitalizations and medication therapy → contribute to heightened anxiety due to the stressful perception of treatment. Reduced physical activity and limited socialization → lead to social anxiety and depressive tendencies. Hypoxia and autonomic nervous system (ANS) imbalance → may exacerbate anxiety through changes in neurotransmitter regulation (serotonin, norepinephrine). Analysis of depressive disorders using the Children's Depression Inventory (CDI):

The CDI evaluates the level of depression, including low mood, loss of interest, feelings of guilt, low self-esteem, and sleep disturbances.

Mean CDI scores in the groups were:

Group I (mild BA): 8.9 ± 2.4

Group II (moderate BA): 12.7 ± 3.1 ($p = 0.026$)

Group III (severe BA): 17.4 ± 4.0 ($p = 0.007$)

In children with mild BA, depressive symptoms were mild. In the moderate BA group, depressive symptoms increased significantly ($p = 0.026$), which may be related to activity limitations and anxiety. In

children with severe BA, depressive disorders were markedly pronounced ($p = 0.007$), indicating significant emotional and cognitive impairments.

Main causes of increased depressive symptoms:

Chronic hypoxia → affects serotonin and dopamine levels, contributing to the development of depression. Frequent limitations and dependence on treatment → can cause psychological frustration and loss of motivation. Social isolation → children with BA may avoid group activities, worsening their emotional state.

Elevated cortisol levels (chronic stress) → can suppress pleasure centers in the brain, contributing to anergia and depressive symptoms. Statistically significant differences in anxiety and depression were found between all groups ($p < 0.05$), confirming the deterioration of psycho-emotional status in severe forms of BA. Mild BA (Group I): moderate anxiety (SCAS = 22.1), rare depressive symptoms (CDI = 8.9). Symptoms have minimal impact on quality of life. Moderate BA (Group II): pronounced anxiety (SCAS = 28.6, $p = 0.028$), moderate depressin (CDI = 12.7, $p = 0.026$). Children experience fear of attacks, leading to emotional instability. Severe BA (Group III): high anxiety (SCAS = 35.2, $p = 0.009$), pronounced depression (CDI = 17.4, $p = 0.007$). These children often develop psycho-emotional disorders requiring psychological intervention. Generally, Increased anxiety is associated with fear of attacks and hypoxia. Pronounced depressive symptoms are linked to chronic stress and social isolation. Statistically significant differences ($p < 0.05$) between groups confirm the impact of BA severity on the psycho-emotional state of children.

Conclusions

Children with bronchial asthma show a significant decline in cognitive functions (memory, attention, executive functions) as the severity of the disease increases. A child's self-esteem and quality of social functioning deteriorate significantly in moderate and severe asthma: anxiety and depressive symptoms increase, and adaptation within peer groups decreases. Autonomic dysfunction (symptoms of sympathetic overactivity, reduced heart rate variability) worsens with increasing asthma severity and interacts with cognitive and emotional impairments. These results emphasize the need for a comprehensive approach to managing children with asthma, including regular neuropsychological and psychological screening, assessment of autonomic regulation, adaptation of the educational process, and psychological support.

References:

1. Tashkent City Health Department. Ежегодный эпидемиологический отчёт по детской бронхиальной астме в Республике Узбекистан за 2018 г. Ташкент, 2019.
2. Министерство здравоохранения Республики Узбекистан. Национальная статистика по бронхиальной астме и хроническим респираторным заболеваниям. Отчёт за 2022 г., Ташкент, 2023.
3. Ismailova N.E., Tursunova D.R., Khodjimatov S.R. Особенности течения бронхиальной астмы у детей в Узбекистане: анализ за 2015–2020 гг. Вестник педиатрии Узбекистана. 2021;5(2):45–52.
4. Jumaev N.N., Abdurakhmanov A.S. Нейрокогнитивные нарушения у детей с тяжёлой бронхиальной астмой. Педиатрическая фармакология и терапия. 2022;17(1):15–22.
5. Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention. 2023 Update. World Health Organization. Asthma Fact Sheet. March 2023.
6. Global Burden of Disease Collaborative Network. Global, regional, and national age-standardized prevalence of asthma, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet Respiratory Medicine. 2023;11(5):431–444.

7. Moonie S., Sterling D.A., Figgs L. W., Castro M. Asthma status and cognitive functioning in children: a review of the literature. Journal of Pediatric Psychology. 2019;44(1):17–26.
8. K P Uvarajan. (2025). Machine Learning-Based EEG Analysis for Early Detection of Alzheimer's Disease in Aging Populations. Frontiers in Life Sciences Research, 1(1), 38–43.
9. Broome M.R., Myles J., Emery C.F. Neurocognitive function in pediatric asthma: A systematic review. Journal of Asthma. 2020;57(9):986–995.
10. Badway M., Partridge M.R., Němec M. Social functioning and quality of life in children with asthma: current insights. Respiratory Medicine. 2018;142:21–28.