

ORIGINAL ARTICLE

THE IMPACT OF OVERWEIGHT AND OBESITY ON THE QUALITY OF LIFE IN CHILDREN WITH BRONCHIAL ASTHMA

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ABSTRACT

The aim is to investigate if the overweight (OW) and obesity (OB) impact on the quality of life (QOL) of children with bronchial asthma (BA).

Materials and methods: The study included 73 children aged 7 – 17, with moderate BA. Depending on the body mass index, patients were divided into the three clinical groups: normal body weight (NW) – 30 children, OW – 28 children and OB – 15 children. QOL was conducted by the Pediatric Asthma Quality of Life Questionnaire (PAQLQ). The statistical processing was carried out using the IBM SPSS Statistics Base (version 22) and EZR version 1.32. Results were considered statistically significant when $p<0.05$.

Results: Children with BA and OB had statistically lower QOL than children with BA and NW in all PAQLQ domains. The Kruskal-Wallis H-test revealed a statistically significant difference between the different weight groups of children with BA both for the general QOL: $H(2) = 37.51$, $p<0.001$and for each rating scale separately. Pairwise comparisons using Steel-Dwass test indicated that scores of NW were observed to be significantly different from those of OW and OB for rating Activity and Symptoms scales ($p<0.001$).

Conclusion: Comorbid OW and OB reduce the specific QOL of children with BA. In assessing the effectiveness of specific approaches to treating BA in children with OW and OB, an assessment of the QOL of children should be added to the traditional common clinical and laboratory assessment.

KEY WORDS: bronchial asthma, overweight, obesity, quality of life, children

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INTRODUCTION

Bronchial asthma (BA) is an important medico-social problem of modern pediatrics, because today , according to WHO, it is the most common chronic pathology in the world among the child population [1]. One of concomitant pathologies that could burden the course of BA are overweight (OW) and obesity (OB), which are also spreading rapidly in the last decade [2]. Both processes, BA and OB, are chronic, complex and multifactorial in their nature.

Therefore, in the GINA materials, 2018, in the list of five major BA phenotypes, BA combined with OB is distinguished into a special phenotype characterized by low levels of eosinophilic inflammation and significantly more shown respiratory symptoms, and needs further study on the mechanisms of interaction and approaches to therapy [3].

Among the main pathogenetic mechanisms of interaction of BA with OW and OB: mechanical effect of adipose tissue on the chest, low-level chronic metabolic inflammation, influence of proinflammatory (leptin, resistin) and anti-inflammatory (adiponectin) hormones of adipose tissue, ox stress, additional co-morbidity, genetic factors. However, the question of a clear causal link between the impact of these mechanisms on the control of BA of this phenotype remains open.

According to the data of Center for Disease Control and Prevention (CDC) US in 2010 share (OB) among adults suffering from BA in this country was 38% [4]. Among the child population, according to Lang JE, 2018, in the USA, between 23 and 27% of new cases of comorbide BA and OB are directly caused by OB, and in the absence of OW and OB, 10% of all cases of BA could be avoided [5]. Based on the analysis of the growth rate of the proportion of the combined course of these two pathologies, over time, BA caused by OB will become a major type of childhood BA [6].

Currently, there are many studies in the field of combination of these two pathologies, mainly among adults, most scientists have clearly identified the features of this combination: a more severe course, that can be seen in more frequent and severe exacerbations and reduced control of the disease, reduced response to treatment with inhaled corticosteroids and lower quality of life [7].

In GINA, 2019 for the management of patients with comorbidity BA-OB states that corticosteroids remain the main therapeutic agents (level of evidence B), although the response to treatment in such patients is weakend. Therefore, it would be desirable to add weight loss recommendations (level of evidence B). In addition, it is noted that scientific researches in this field are limited and insufficient [8].

Inadequate treatment of BA in children leads to an uncontrolled course with the preservation of inflammatory changes in the bronchi and the persistence of bronchial obstruction, which worsens both the physical and emotional state of the patient and significantly reduces the social activity. The chronic nature of BA and related phar-

macotherapy, sometimes physical and social limitations, emotional factors can be much more important for a child with BA than the symptoms of the illness itself.

Common clinical and laboratory assessment of respiratory tract and inflammatory markers provides valuable information about the condition of the affected organ system, but it does not capture the functional disorders (physical, emotional and social) that are important for patients with BA in their daily lives [9]. It is increasingly recognized that assessment of positive changes in the quality of life (QOL) of patients should be taken into account for the evaluation of therapeutic interventions in BA [10].

WHO defines QOL as individuals' perceptions of their lives in the context of the culture and value systems in which they live, and in accordance with their goals, expectations, standards and challenges [11]. The purpose of treatment of BA should be considered to increase the QOL of a sick child on the background of positive clinical dynamics.

Limited pediatric studies of QOL of children with BA combined with OB, compared to BA with NW contain findings that sometimes contradict each other [12, 13, 14].

It has been confirmed that concomitant OW and OB, which complicate the course of chronic pathological conditions of patients, significantly worsen QOL [15]. Considering the negative impact that OB has on the prevalence and course of BA, changes in QOL and in patients with BA should be expected. Therefore, it is advisable to conduct further studies to evaluate how the comorbide course of BA and OB affects the QOL of children with BA.

THE AIM

The aim of this study was to investigate if the overweight OW and OB impact on the QOL of children with BA.

MATERIALS AND METHODS

A one-year cross-sectional study was conducted (February 2019 – February 2020) 73 children aged 7 - 17 years with moderate BA who were treated in the allergic department of the children's hospital were examined. Depending on the body mass index, patients were divided into the following clinical groups: group I – 30 children with NW (body mass index ranged from 5 to 85 percentile according to age and sex), group II – 28 children with OW (body mass index from 85 to 94 percentile) and group III – 15 children with OB (body mass index greater than 95 percentiles).

A specialized PAQLQ (Pediatric Asthma Quality of life Questionnaire) questionnaire, developed for children with bronchial asthma aged 7 to 17 years [9], has been used to evaluate QOL in children with bronchial asthma, translated and linguistically validated by the Lyon Research Institute, France (MAPI Research Institute) in many languages, including Ukrainian [16].

The PAQLQ questionnaire contains 23 questions, grouped into 3 blocks (rating scale), that relate to the most relevant life spheres for children with asthma: asthma symptoms (10 points), emotional disturbance (8 points), and activity restriction (5 points). Depending on how often during the last week the patient experienced some or all of asthmatic symptoms assessment was made by the 7-point Likert scale from 1 (extremely worries/all time) to 7 (does not bother/never). The indicators for each block were obtained by calculating the average result. The total QOL score (QOL) was calculated as the average for all blocks. The number of points is directly proportional to the QOL, that is, the higher the score, the higher the QOL score. The questionnaire was filled in by the interview method according to the instructions for the application of the questionnaire.

The results of the questionnaire survey of patients on the PAQLQ were divided into 4 blocks: activity limitation (QOL activity), symptoms (QOL symptom), emotional disturbance (QOL emotion), and total QOL score (QOL). Each block contained scores in three compared groups of patients with BA (NW, OW, OB). The research database was systematized in Microsoft Excel.

The statistical processing of obtained results was carried out using the statistical package IBM SPSS Statistics Base (version 22) and EZR software version 1.32 (R graphical interface (version 2.13.0) [17].

For descriptive statistics, to determine if a data set is well-modeled by a normal distribution, was used by Shapiro-Wilk test. Because the distribution was different from normal (Gaussian), and therefore the statistical sample was heterogeneous, methods of nonparametric statistics were used. Median and interquartile ranges [first; third] – Me (QI;QIII) were determined to describe the variance of the compared variables (quantitative QOL scores for each block, and respectively, for each group in blok). Results were considered statistically significant when $p<0.05$.

The Kruksal-Wallis H-test (or one-way ANOVA on ranks) was used to determine if there are statistically significant differences in QOL scores between three comparison groups (NW, OW, OB). This criterion reveals whether there is a statistically significant change in the level of trait (QOL score) when moving from one weight group to another.

In confirming statistical significance, post hoc analysis was performed to assess which groups actually differ from each other. For pairwise comparisons of the quantitative indices the nonparametric Steel-Dwass test was used.

As for clinical significance of the difference between the mean values of the compared indicators of the questionnaire, the value of 0.5 unit was accepted as the minimal difference accordance to recommendations of PAQLQ developers Juniper et al [18] and the experience of PAQLQ evaluation in clinical studies [10].

The present work meets the requirements of the Declaration of Helsinki. The research was carried out in compliance with the modern principles of bioethics. The design of this study was approved by the commission on bioethical expertise and ethics of scientific research at the National Medical University named after O.O. Bogomolets, the research does not present an increased risk for the subjects of the study and was implemented in view

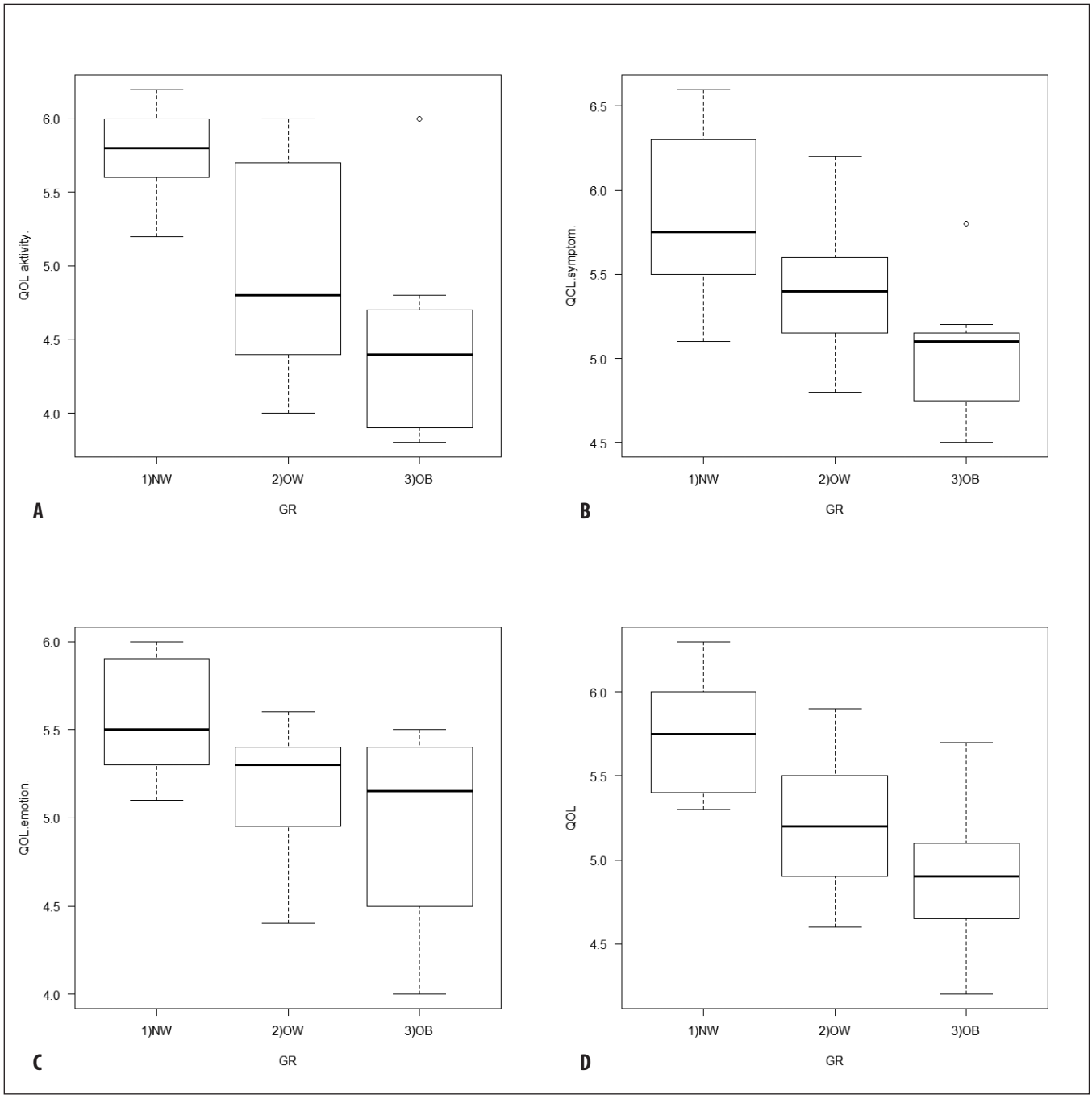

Fig. 1. Comparative characteristics of QOL for different weight groups of children with BA (NW, OW, OB) on each scale of the PAQLQ questionnaire: A - activity (QOL.activity), B - symptoms (QOL.symptom), C - emotions (QOL.emotion), and D is the total QOL score.

of existing bioethical norms and scientific standards for conducting clinical trials involving patients. All patients signed a written informed consent form.

RESULTS

Figure 1, A to D, present graphically the results of the Kruskal-Wallis H-test for change in the level of the trait (QOL score) from one weight group (NW, OW, OB) to another for different domains of QOL.

The Kruskal-Wallis H-test revealed a statistically significant difference between the different weight groups of children with BA both for the general QOL: $H(2) = 37.51$, $p<0.001$; and for each rating scale separately: activity: $H(2) = 36.238$, $p<0.001$; symptoms: $H(2) = 30.009$, $p<0.001$; and emotions: $H(2) = 15.855$, $p<0.001$.

Table I shows the calculated average values (as Me [QI ;QIII]) of QOL for each of the studied groups of children with BA (NW, OW, OB) and the result of post-hoc comparisons of these groups by the Steel-Dwass Test on the statistical significance of the difference between weight groups.

BA had the least negative impact on QOL in children with NW, which was confirmed by fairly high rates. Pairwise comparisons using Steel-Dwass Test indicated that

Table I. QOL indicators of children with BA with different body weights according to the PAQLQ questionnaire, Me [QI; QIII]

Rating scale	Groups of patients with BA			Statistical significance of the difference between groups *
	NW, n = 30	OW, n = 28	OB, n = 15	
	1	2	3	
Activity restrictions	5,8 [5,6; 6]	4,9 [4,4; 5,8]	4,4 [3,8; 4,6]	p_{12}<0,001 p_{13}<0,001 p_{23}=0,048
Symptoms	5,75 [5,5; 6,3]	5,4 [5,15; 5,65]	5,1 [4,5; 5,1]	p_{12}<0,001 p_{13}<0,001 p_{23}=0,003
Emotions	5,5 [5,3; 5,9]	5,3 [4,95; 5,4]	5 [4,5; 5,4]	p_{12}=0,006 p_{13}=0,001 p_{23}=0,4
Overall QOL score	5,75 [5,4; 6]	5,25 [4,9; 5,5]	4,8 [4,6;5,1]	p_{12}<0,001 p_{13}<0,001 p_{23}=0,016

* the result of pairwise comparisons of groups among themselves according to the Steel-Dwass Test , the difference is considered significant at p <0.001

group NW scores were observed to be significantly different from those of group OW (p <0.001) and group OB (p <0.001) for rating scales "Activity" and "Symptoms" .

The difference between the OW group and the OB group was not statistically significant. On the Emotions scale, the difference was significant only when comparing the NW group and the OB group.

As for the clinical interpretation of the difference between average values of the NW group and the OB group, according to the data in Table 1, the threshold of minimal clinical significance is 0.5 is exceeded for each rating scale, so the results obtained show that the difference between QOL indices of a NW group of children and a group of OB are not only statistically but also clinically significant.

DISCUSSION

In our study, we evaluated the relationship between BA with concomitant OW or OB and QOL in children measured by trusted and well-known specialized questionnaire PAQLQ .

With regard to the use of questionnaires for the assessment of QOL, it is known [10] that specialized questionnaires have a higher specificity and sensitivity to detect the smallest differences in groups of patients with regard to the characteristics of the disease being studied. Unlike specialized, general questionnaires are usually designed to assess the significant impact of chronic diseases on QOL, making them less sensitive to the small differences between the study groups.

Results of the use the PAQLQ questionnaire in clinical trials are presented in over 46 scientific publications) [10] but it should be noted, the number of studies on the QOL of children with comorbide course of BA and OB is quite small. In addition, a significant limitation of the study is the size of the sample and the criteria for inclusion in the study, so the results of existing studies sometimes contradict each other, especially regarding the impact on different scales of QOL assessment [12, 13 , 14].

In our study, it was shown that the total negative impact of BA and comorbide OW or OB on the QOL of children was greater than the isolated impact of BA. Children with BA and concomitant OB had statistically and clinically significant lower rates of overall QOL compared with children with BA with normal-weight. It has also been found that the negative impact of OW and OB becomes greater as BMI increases.

Declines in QOL scores on different PAQLQ scales were associated with some limitations in children's daily activities and interactions with adults and peers. Thus, the decrease in QOL indicators on the activity limitation scale in children with BA with OW and OB, indicated their lower physical activity compared to children with asthma who had a NW. Such a decrease in physical activity in children with BA with OW or OB is associated with difficulties in performing daily physical activities such as cleaning, lifting and carrying small objects, moving on stairs and during inclinations and squats. It should be noted that the difference between the weight groups was the most significant on this scale.

The decrease in QOL indices on the scale of "Emotions" in the children of the main group was due to the negative impact of physical and psycho-emotional problems associated with limiting the life activity of children with BA with concomitant OW or OB. Thus, the daily activities of children in the main group were accompanied by physical difficulties caused by OW or OB, and these difficulties created an additional negative impact on the emotional state of children. The emotional state of children suffering from BA with concomitant OW or OB, compared to patients with isolated course of BA, hindered the daily activity of children, requiring more time to perform their usual tasks. These emotional experiences of children also worsened compliance with them, making the treatment process more complicated.

At present, population data about the impact of OW or OB on QOL in children with BA are quite limited and

need further study. Our findings for children are consistent with the results obtained in numerous studies with adult patients with BA who have shown a significant connection between BMI and quality of life.

CONCLUSIONS

The impact of OB on the indicators of QOL of children with BA is statistically and clinically significant.

Comorbid OW and OB reduce the desease-specific QOL of children with BA in all PAQLQ domains.

These comorbidity requires the development of specific treatment regimens of BA, the effectiveness of which should be evaluated taking into account the QOL of children.

The PAQLQ is a sensitive tool for the assessment of QOL in children with BA combined with OW and OB, and can be recommended as an additional tool for evaluating the effectiveness of treatment regimens.

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Conflict of interest:
The Authors declare no conflict of interest.

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