ORIGINAL ARTICLE

CONTENTS

Dynamic morphofunctional characteristics of the respiratory tract in children with recurrent respiratory diseases depending on the method of therapy

Olesya M. Horlenko, Oksana M. Berezovska, Lyubomyra B. Prylypko, Valeriya V. Brych, Yana V. Lazur, Kristian O. Debretseny, Lyubov A. Halay
UZHHOROD NATIONAL UNIVERSITY, UZHHOROD, UKRAINE

ABSTRACT

Aim: To investigate the data of the morphofunctional study of the respiratory tract in children with recurrent respiratory diseases in dynamics, depending on the method of therapy.

Materials and Methods: The study included 118 children of primary school age with a diagnosis of recurrent respiratory diseases and 26 healthy children identical in age, gender and anthropometric parameters. Two study groups were created, depending on the treatment method: group 1 – 62 patients (optimized therapy,OT), group 2 – 56 patients (basic therapy,BT).

Results: Significant differences after treatment were observed in following spirogram indicators: FVC (%) at $p_1<0,01$, $p_3=0,008$ in the OT group; FEV1 (%) at $p_1=0,001$, $p_3=0,01$ in the group with OT; PEF (%) at $p_1=0,02$ in the group of children of OT and $p_4=0,006$ in the group of children of BT; MEF 25 (%) with $p_1=0,03$, $p_3=0,05$ in the group of OT children and $p_4=0,01$ in the group of BT children; Tifno index (%) at $p_4=0,002$, $p_6=0,01$, $p_7=0,02$ with significant changes between the data on OT and BT groups; MEF 50 (%) at $p_7=0,01$ with a significant prevalence of OT data (by 1,2 times) against BT data.

Conclusions: The obtained data allow us to say that the addition of vitamin-mineral complex drugs to the standard treatment regimen has a positive effect on the state of the respiratory system in children with a diagnosis of recurrent respiratory diseases.

KEY WORDS: recurrent respiratory diseases, acute respiratory diseases, morphofunctional characteristic, children, therapy

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INTRODUCTION

Breathing is one of the most important vital functions of the human body and determines the gas exchange between the external environment and the child's body, due to the consumption of oxygen, the release of carbon dioxide and the generation of energy necessary for cellular metabolism. The following gradation is distinguished – external respiration, transport of gases by blood and gas exchange in tissues, or internal respiration. External breathing includes: ventilation of the lungs, diffusion of gases through the alveolar-capillary membrane and processes of blood perfusion in the pulmonary capillaries. Violation at one of the levels of this physiological process leads to changes in breathing and, as a result, the occurrence of respiratory failure. Therefore, the methods of researching the function of external breathing are of great diagnostic value.[1]

Spirometry is one of the most informative tests for analyzing and evaluating lung function. To date, when studying the function of external breathing, the volume of various phases of the respiratory cycle and the flow rate during inhalation and exhalation are measured.[2]

AIM

To investigate the data of the morphofunctional study of the respiratory tract in children with recurrent respiratory diseases in dynamics, depending on the method of therapy.

MATERIALS AND METHODS

Our study examined a group of children with acute respiratory diseases: J01 – acute sinusitis; J02, J02.9 – acute pharyngitis, unspecified; J03, J03.9 – acute tonsillitis, unspecified; J06.9 – acute upper respiratory tract infection, unspecified; J20, J20.9 – acute bronchitis, unspecified; H66.9 – otitis media, unspecified, identified more than 6 times a year. Two study groups were created, depending on the treatment method: group 1 – 62 patients (optimized therapy), group 2 – 56 patients (basic therapy). The control group consisted

of 26 healthy examined children, identical in age, sex, and anthropometric parameters, without clinical and laboratory presentations of acute respiratory syndrome. A group of children (1) received therapy with the addition of vitamin-mineral complex drugs to the standard treatment regimen for 1 month in therapeutic doses. The developed treatment scheme was aimed at promoting rapid recovery and preventing further episodes of acute respiratory diseases.

RESULTS

Many indicators are studied, in particular, the volume of air exhaled for certain periods of time during full exhalation, which is preceded by a maximum inhalation, is determined. Variables that include total expiratory volume (forced vital capacity (FVC), the volume exhaled in the first second, known as forced expiratory volume in the first second (FEV1), and their ratio (FEV1/FVC) are also determined. The results of the study, both volumes and combinations of these volumes, are called capacities, and are used as a diagnostic test to monitor patients with respiratory diseases.[3]

Let's consider the main parameters of the spirogram in the studied children when using different methods of therapy (Table 1).

A step-by-step approach to spirometry ensures ease and reliability of interpretation. Airway obstruction is suspected when there is a decrease in forced expiratory volume in first second/forced vital capacity (FEV1/FVC), but there is no conclusive evidence to clearly define what constitutes a significant decrease in this ratio. Low FVC is defined as less than 80 % of predicted in children and adolescents aged 5 to 18 years. The FEV1/FVC ratio and FVC are used together to identify obstructive defects and restrictive or mixed patterns. FEV1 is used to determine the severity of obstructive and restrictive disease, although the values were determined arbitrarily and were not based on patient outcome data.[4]

According to Table 1, positive dynamics were observed after treatment on all indicators. Significant differences after treatment were observed in the following parameters: FVC (%) at $p_1<0,01$, $p_3=0,008$ in the OT group; FEV1 (%) at $p_1=0,001$, $p_3=0,01$ in the group with OT; PEF (%) at $p_1=0,02$ in the group of children of OT and $p_4=0,006$ in the group of children of BT; MEF 25 (%) with $p_1=0,03$, $p_3=0,05$ in the group of OT children and $p_4=0,01$ in the group of BT children; Tifno index (%) at $p_4=0,002$, $p_6=0,01$, $p_7=0,02$ with significant changes between the data on OT and BT groups, which characterizes the increase of clinically useful air flow with the predominance of OT data; MEF 50 (%) at $p_7=0,01$ with a significant prevalence of OT data (by 1,2 times) against BT data. The indicator indicates a decrease in the narrowing of the respiratory tract.[5–7]

Let's consider the changes in the main indicators during the study of children with OT (Table 2).

According to Table 2, positive dynamics of spirometry indicators were observed. The level of the FVC indicator (%) reached physiological values in 84,61 % of cases, compared to the starting values – 73,08 %. Moderate, significant and drastic changes were also not observed after treatment. IVC (%) increased after treatment by 1,2 times, no significant and drastic changes were identified. The value of FEV1 (%) increased (from 80,77 % to 92,31 %) and no easy, moderate, significant, or drastic changes were detected. The level of FEV 25-75 (%) reached 100 % in all OT children. The level of PEF (%) increased after treatment by 1,2 times, and moderate, significant, drastic changes in the indicator were not observed.

Taking into account the needs of clinical assessment of respiratory function, two types of ventilation insufficiency are distinguished: obstructive and restrictive, as well as mixed-type disorders. Obstructive type is characterized by impaired passage of air to the alveoli. For restrictive – a decrease in the respiratory surface or the ability of the lung tissue to stretch.[8]

Consider the presence of obstructive and restrictive disorders in children with OT:

BEFORE TREATMENT

1. Obstructive and restrictive violations were not detected – 75,01 %
2. Restrictive violations of a light degree of severity. Poor breathing mechanics – 1,92 %
3. Restrictive violations of a light degree of severity – 19,23 %
4. Obstructive disorders of a light degree of severity. Restrictive violations of medium severity – 1,92 %
5. Obstructive disorders of a light degree of severity – 1,92 %

DURING TREATMENT

1. Obstructive and restrictive violations were not detected – 78,84 %
2. Restrictive violations of a light degree of severity – 17,31 %
3. Restrictive violations of medium severity – 3,85 %

AFTER TREATMENT

1. Obstructive and restrictive violations were not detected – 88,46 %
2. Restrictive violations of a light degree of severity – 11,54 %.

Table 1. Data of spirograms in children with the use of various methods of therapy

Parameters of spirometry	The mean value of the norm with standard deviation for our sample	1st group - OT (n=62)			2nd group - BT (n=56)		
		Before treatment	During treatment	After treatment	Before treatment	During treatment	After treatment
FVC (L) forced vital capacity	1,89±0,38	1,68 ± 0,36	1,79 ± 0,37 (p_1=0,08)	1,79 ± 0,45 (p_2=0,92; p_3=0,14)	1,71 ± 0,26	1,86 ± 0,38 (p_4=0,02)	1,87 ± 0,30 (p_5=0,97; p_6=0,005; p_7=0,23)
FVC (%)		88,11 ± 12,44	97,37 ± 15,36 (p_1<0,01)	94,68 ± 14,63 (p_2=0,32; p_3=0,008)	92,20 ± 11,63	95,64 ± 10,82 (p_4=0,11)	94,66 ± 9,36 (p_5=0,61; p_6=0,22; p_7=0,99)
IVC (L) inspiratory vital capacity	1,89±0,38	1,63 ± 0,44	1,69 ± 0,39 (p_1=0,38)	1,71 ± 0,49 (p_2=0,83; p_3=0,32)	1,76 ± 0,34	1,77 ± 0,42 (p_4=0,95)	1,86 ± 0,38 (p_5=0,22; p_6=0,16; p_7=0,07)
IVC (%)		85,98 ± 16,00	91,43 ± 14,71 (p_1=0,05)	90,11 ± 15,82 (p_2=0,63; p_3=0,15)	95,87 ± 20,51	89,97 ± 14,58 (p_4=0,08)	93,32 ± 12,10 (p_5=0,19; p_6=0,42; p_7=0,22)
FEV1 (L) forced expiratory volume in 1st second	1,66±0,31	1,53 ± 0,35	1,63 ± 0,30 (p_1=0,09)	1,63 ± 0,35 (p_2=0,99; p_3=0,11)	1,55 ± 0,25	1,69 ± 0,30 (p_4=0,006)	1,70 ± 0,24 (p_5=0,86; p_6=0,001; p_7=0,19)
FEV1 (%) forced expiratory volume 1%	90,27±1,21	92,28 ± 14,18	100,00 ± 11,64 (p_1=0,001)	98,35 ± 11,84 (p_2=0,43; p_3=0,01)	95,89 ± 15,67	98,84 ± 9,18 (p_4=0,23)	98,29 ± 8,64 (p_5=0,75; p_6=0,32; p_7=0,98)
Tifno index (%) FEV1 / IVC	90,27±1,21	95,84 ± 12,95	98,27 ± 15,02 (p_1=0,34)	97,68 ± 10,28 (p_2=0,79; p_3=0,38)	88,94 ± 8,69	99,49 ± 22,66 (p_4=0,002)	93,33 ± 9,69 (p_5=0,06; p_6=0,01; p_7=0,02)
FEF 25-75 (L/s) forced expiratory flow	2,08±0,24	2,06 ± 0,53	2,12 ± 0,42 (p_1=0,47)	2,15 ± 0,44 (p_2=0,69; p_3=0,30)	2,09 ± 0,51	2,22 ± 0,34 (p_4=0,11)	2,12 ± 0,47 (p_5=0,20; p_6=0,72; p_7=0,75)
FEF 25-75 (%)		99,05 ± 22,13	103,25 ± 18,49 (p_1=0,25)	102,99 ± 17,33 (p_2=0,93; p_3=0,27)	103,50 ± 27,52	105,19 ± 13,89 (p_4=0,68)	98,84 ± 19,02 (p_5=0,05; p_6=0,30; p_7=0,22)
FEF 75-85 (L/s) forced expiratory flow		1,01 ± 0,32	1,05 ± 0,29 (p_1=0,38)	1,06 ± 0,23 (p_2=0,84; p_3=0,44)	1,12 ± 0,30	1,09 ± 0,28 (p_4=0,49)	1,05 ± 0,29 (p_5=0,56; p_6=0,23; p_7=0,87)
PEF (L/s) peak expiratory flow	3,62±0,61	3,41 ± 0,89	3,65 ± 0,70 (p_1=0,10)	3,72 ± 0,81 (p_2=0,60; p_3=0,04)	3,32 ± 0,51	3,89 ± 0,74 (p_4<0,01)	3,80 ± 0,50 (p_5=0,43; p_6<0,01; p_7=0,51)
PEF (%)		96,46 ± 24,09	105,59 ± 20,34 (p_1=0,02)	102,08 ± 19,59 (p_2=0,33; p_3=0,16)	95,85 ± 19,86	106,26 ± 19,29 (p_4=0,006)	100,89 ± 10,75 (p_5=0,07; p_6=0,09; p_7=0,69)

Table 1. Cont.

MEF 25 (L/s) maximum expiratory flow	3,42±0,55	2,93 ± 0,84	3,09 ± 0,60 (p_1=0,20)	3,23 ± 0,71 (p_2=0,28; p_3=0,03)	2,79 ± 0,61	3,31 ± 0,65 (p_4<0,01)	3,22 ± 0,46 (p_5=0,38; p_6<0,01; p_7=0,96)
MEF 25 (%)		86,28 ± 23,22	94,69 ± 17,81 (p_1=0,03)	93,81 ± 19,32 (p_2=0,79; p_3=0,05)	85,10 ± 21,55	94,82 ± 18,25 (p_4=0,01)	90,76 ± 13,05 (p_5=0,18; p_6=0,09; p_7=0,32)
MEF 50 (L/s) maximum expiratory flow	15,6±10,99	2,20 ± 0,57	2,27 ± 0,47 (p_1=0,43)	2,29 ± 0,48 (p_2=0,86; p_3=0,35)	2,22 ± 0,49	2,39 ± 0,36 (p_4=0,04)	2,26 ± 0,56 (p_5=0,15; p_6=0,70; p_7=0,75)
MEF 50 (%)		75,14 ± 37,73	86,68 ± 31,57 (p_1=0,07)	87,33 ± 26,75 (p_2=0,90; p_3=0,04)	74,58 ± 43,59	75,62 ± 38,27 (p_4=0,89)	71,57 ± 40,91 (p_5=0,59; p_6=0,71; p_7=0,01)
MEF 75 (L/s) maximum expiratory flow	1,24±0,11	1,30 ± 0,36	1,31 ± 0,31 (p_1=0,78)	1,28 ± 0,26 (p_2=0,58; p_3=0,84)	1,33 ± 0,34	1,34 ± 0,27 (p_4=0,87)	1,28 ± 0,32 (p_5=0,27; p_6=0,41; p_7=0,92)
MEF 75 (%)		104,13 ± 25,98	107,49 ± 23,39 (p_1=0,45)	102,62 ± 18,27 (p_2=0,20; p_3=0,71)	109,61 ± 30,81	105,62 ± 17,44 (p_4=0,40)	100,02 ± 23,28 (p_5=0,15; p_6=0,07; p_7=0,49)

Notes: p_1 – statistical significance of differences in 1st group between the values of indicators before and during treatment; p_2 – statistical significacnce of the differences in 1st group between the values of indicators during and after treatment; p_3 – statistical significance of the differences in 1st group between the values of indicators before and after treatment; p_4 – statistical significance of the differences in the 2nd group between the values of indicators before and during treatment; p_5 – statistical significance of the differences in the 2nd group between the values of indicators during and after treatment; p_6 – statistical significance of the differences in the 2nd group between the values of indicators before and after treatment; p_7 – statistical significance of the differences between the values of indicators of groups 1 and 2 after treatment.

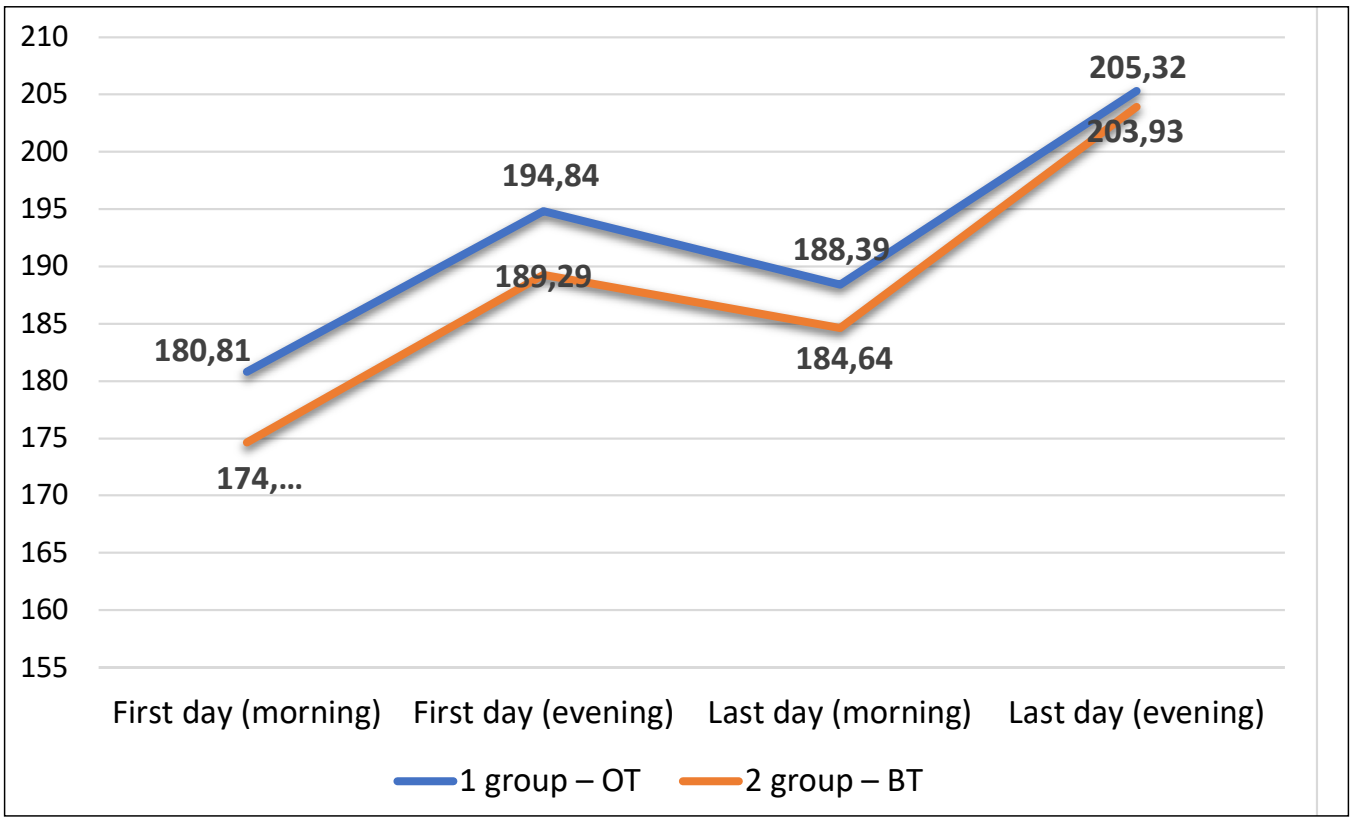

Fig. 1. Graphical representation of the results of the peak flowmetry study.

Table 2. Changes in spirometry indicators of the group of children with OT

Parameters of spirometry	1st group – OT (n=62)																	
	Before treatment						During treatment						After treatment					
	Norm	Conditional norm	Easy changes	Moderate changes	Significant changes	Drastic changes	Norm	Conditional norm	Easy changes	Moderate changes	Significant changes	Drastic changes	Norm	Conditional norm	Easy changes	Moderate changes	Significant changes	Drastic changes
FVC forced vital capacity (%)	73,08	11,54	11,54	0	1,92	1,92	78,84	11,54	9,62	0	0	0	84,61	9,62	5,77	0	0	0
IVC inspiratory vital capacity (%)	65,38 %	11,55	15,37 %	3,86	3,84	0	61,53 %	17,31 %	17,31 %	0	3,85	0	75,00 %	13,46 %	7,69	3,85	0	0
FEV1 forced expiratory volume in 1st second (%)	80,77	7,69	5,77	1,92	3,85	0	82,70	15,38	1,92	0	0	0	92,31	7,69	0	0	0	0
FEF 25-75 forced expiratory flow (%)	90,39	1,92	7,69	0	0	0	94,23	5,77	0	0	0	0	100	0	0	0	0	0
PEF peak expiratory flow (%)	76,92	11,54	7,69	0	3,85	0	88,50	9,62	1,92	0	0	0	94,30	3,85	1,92	0	0	0

There is also a positive trend in the level of violations. At the initial stage of the study, obstructive and restrictive disorders were not detected – in 75,01 % of cases, while after treatment – in 88,46 %.

Let's consider changes in spirometry indicators in children with BT (Table 3).

According to the table, positive dynamics were observed in spirometry values, but it was not possible to reach 100 % of the physiological norm. There was an increase in the final indicators of FVC (%), IVC (%), FEV1 (%), FEF 25-75 (%) by 1,1 times, PEF (%) by 1,2 times. Moderate, significant, drastic changes were not observed after treatment in terms of FVC (%), FEV1 (%) (even easy changes were not noted), FEF 25-75 (%), PEF (%), according to the IVC indicator (%) there were additionally moderate changes.

According to the characteristics of the presence of obstructive and restrictive changes in children with BT, the following results were obtained:

BEFORE TREATMENT

1. Obstructive and restrictive violations were not detected – 74,88 %
2. Restrictive violations of a light degree of severity. Poor breathing mechanics – 2,01 %

Table 3. Changes in spirometry indicators of a group of children with BT

Parameters of spirometry	2nd group – BT (n=56)																	
	Before treatment						During treatment						After treatment					
	Norm	Conditional normv	Easy changes	Moderate changes	Significant changes	Drastic changes	Norm	Conditional norm	Easy changes	Moderate changes	Significant changes	Drastic changes	Norm	Conditional norm	Easy changes	Moderate changes	Significant changes	Drastic changes
FVC forced vital capacity (%)	73,08	10,67	12,02	0	1,92 %	2,02	7 5,91	10,51	10,58	3,00	0	0	82,16	9,58	8,26	0	0	0
IVC inspiratory vital capacity (%)	64,94	11,88	14,50	5,02	3,66	0	62,48	16,31	17,29	0	3,92	0	73,46	14,21	9,37	2,96	0	0
FEV1 forced expiratory volume in 1st second (%)	80,73	7,22	6,12	1,96	3,97	0	84,17	14,01	1,82	0	0	0	90,26	9,74	0	0	0	0
FEF 25-75 forced expiratory flow (%)	89,47	3,85	6,78	0	0	0	95,18	3,27	1,55	0	0	0	97,56	1,26	1,18	0	0	0
PEF peak expiratory flow (%)	76,12	11,106	8,92	0	3,86	0	85,31	12,38	2,31	0	0	0	91,18	6,81	2,01	0	0	0

3. Restrictive violations of a light degree of severity – 18,79 %
4. Obstructive disorders of a light degree of severity. Restrictive violations of medium severity – 1,80 %
5. Obstructive disorders of a light degree of severity – 2,52 %

DURING TREATMENT

1. Obstructive and restrictive violations were not detected – 76,98 %
2. Restrictive violations of a light degree of severity – 15,26 %
3. Restrictive violations of medium severity – 8,76 %

AFTER TREATMENT

1. Obstructive and restrictive violations were not detected – 81,52 %
2. Restrictive violations of a light degree of severity – 18,48 %.

The level of obstructive and restrictive disorders decreased by 1,1 times, and breathing mechanics disorders were eliminated. Restrictive violations of a light degree of severity were registered in 18,48 % of cases.

In the studied children, the Stange's test with breath hold on inhalation and the Hench's test – breath hold on exhalation were performed before and after treatment (Table 4).

Table 4. The results of the Stange's and Hench's tests in children with the use of various methods of therapy

Parameters	1st group – OT (n=62)		2nd group – BT (n=56)	
	Before treatment	After treatment	Before treatment	After treatment
Stange's test (min 21s)	20,59 ± 5,19	21,95 ± 4,89 (p_1=0,14)	20,29 ± 4,65	21,80 ± 4,17 (p_2=0,07; p_3=0,86)
Hench's test (min 12-13 s)	13,34 ± 3,89	15,58 ± 3,77 (p_1=0,001)	12,86 ± 3,64	15,16 ± 3,47 (p_2=0,53 p_3=0,001)

Notes: p_1 – statistical significance of the differences in the 1st group between the values of indicators before and after treatment; p_2 – statistical significance of the differences in the 2nd group between the values of indicators before and after treatment; p_3 – statistical significance of the differences between the values of indicators after treatment of groups 1 and 2.

Table 5. The results of peak flowmetry in children depending on the method of treatment

Peak flowometry	1st group – OT (n=62)	2nd group – BT (n=56)	Statistical significance of differences
1st day (morning)	180,81 ± 41,82	174,64 ± 29,35	0,36
1st day (evening)	194,84 ± 40,32	189,29 ± 28,28	0,39
Last day (morning)	188,39 ± 39,84 (p_1=0,30)	184,64 ± 27,30 (p_2=0,07)	0,56
Last day (evening)	205,32 ± 40,48 (p_1=0,05)	203,93 ± 28,52 (p_2=0,01)	0,83

Notes: p_1 – statistical significance of differences in 1st group between the values of indicators before and after treatment; p_2 – statistical significance of the differences in the 2nd group between the values of indicators before and after treatment.

According to the data, there were significant differences in the Hench's test indicator, both in the OT group (p_1=0,001) and between groups (p_3=0,001), with a predominance in the OT group (15,58 ± 3,77 vs. 15,16 ± 3,47 s). The obtained data on the study of the Stange's test increased to the physiological norm, but without reliable values [9–11].

Peak flowmetry is a method of functional diagnostics to determine the peak volume velocity of exhalation. This method makes it possible to assess the speed with which a person exhales air, and thus determine the degree of obstruction (narrowing) of the respiratory tract [11].

Consider the obtained peak flowmetry data (Table 5, Fig. 1).

After the peak flowmetry study, a significant positive dynamics of the values (p_1=0,05, p_2=0,01) was observed in both groups with an absolute difference between the groups and with a predominance of values in the OT group.

DISCUSSION

Spirometry is most often performed to study and evaluate lung function. This method provides clinically useful information for making decisions about the treatment of a wide range of diseases and disorders of the respiratory tract. Being a non-invasive and accessible method, which is very important in childhood, and almost completely without any adverse consequences, it can be repeated as often as there is a need for it.[12]

Interpretation of spirometry data requires knowledge of the pathophysiology of lung diseases, it also requires a rational familiarity with statistics [13].

Thus, each person will have different «normal» or expected values, which are also not fixed or constant, and are constantly changing with growth and aging. For each lung function parameter the expected value, the normal value is calculated using «prediction» or «regression» or «reference» equations that take into account known and unknown predictors or determinants of the parameter of interest. These equations are developed by studying lung function, and a large sample of carefully selected and well-defined «normal» subjects. The criteria for normality are strict, excluding sick people. In studies such as the National Health and Nutrition Examination Survey of the United States III (NHANES III), a sample of normal subjects was selected from the entire population [14–17].

Spirometry is a valuable and informative method of research and monitoring in the process of treatment of various diseases of the respiratory tract, but it has limitations in detecting early disease and in patients with borderline disorders, and therefore provides

information only about the mechanical properties of the respiratory tract, lungs and chest wall, and gives enough information to determine a preliminary diagnosis [18,19].

CONCLUSIONS

1. Significant differences after treatment were observed in the following parameters: FVC (%) at $p_1<0,01$, $p_3=0,008$ in the OT group; FEV1 (%) at $p_1=0,001$, $p_3=0,01$ in the group with OT; PEF (%) at $p_1=0,02$ in the group of children of OT and $p_4=0,006$ in the group of children of BT; MEF 25 (%) with $p_1=0,03$, $p_3=0,05$ in the group of OT children and $p_4=0,01$ in the group of BT children; Tifno index (%) at $p_4=0,002$, $p_6=0,01$, $p_7=0,02$ with significant changes between the data on OT and BT groups, which characterizes the increase of clinically useful air flow with the predominance of OT data; MEF 50 (%) at $p_7=0,01$ with a significant prevalence of OT data (by 1,2 times) against BT data.
2. Positive dynamics of spirometry indicators were observed in children with OT. The level of the FVC indicator (%) reached physiological values in 84,61 % of cases, compared to the starting values – 73,08 %. Moderate, significant and drastic changes were also not observed after treatment. IVC (%) increased after treatment by 1,2 times, no significant and drastic changes were identified. The value of FEV1 (%) increased (from 80,77 % to 92,31 %) and no easy, moderate, significant, or drastic changes were detected. The level of FEV 25-75 (%) reached 100 % in all OT children. The level of PEF (%) increased after treatment by 1,2 times, and moderate, significant, drastic changes in the indicator were not observed.
3. At the initial stage of the study of children from the OT group, obstructive and restrictive disorders were not detected in 75,01 % of cases, while after treatment – in 88,46 %. Restrictive violations of a mild degree of severity after treatment were found in 11,54 % of cases.
4. A positive trend in spirometry values was determined in children with BT, but it was not possible to reach 100 % of the physiological norm. There was an increase in the final indicators of FVC (%), IVC (%), FEV1 (%), FEF 25-75 (%) by 1,1 times, PEF (%) by 1,2 times. According to spirometry data, no moderate, significant, drastic changes in violations were detected after treatment in terms of FVC (%), FEF 25-75 (%), PEF (%), with the exception of FEV1 (%) (when even easy changes were not noted) and according to the data of the IVC indicator (%) no significant and drastic changes were observed.
5. The level of obstructive and restrictive disorders decreased by 1,1 times in children with BT, and breathing mechanics disorders were eliminated. Restrictive violations of a light degree of severity were registered in 18,48 % of cases.
6. There were significant differences in the Hench's test indicator, both in the OT group ($p_1=0,001$) and between groups ($p_3=0,001$), with a predominance in the OT group ($15,58 \pm 3,77$ vs. $15,16 \pm 3,47$ s). The obtained data from the Stange's test indicated an increase in the level to the physiological norm, but without reliable values.
7. After the peak flowmetry study, a significant positive dynamics of the values ($p_1=0,05$, $p_2=0,01$) was observed in both groups with an absolute difference between the groups and with a predominance of values in the OT group.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

CORRESPONDING AUTHOR

Olesya M. Horlenko
Uzhhorod National University
14 Universytetska St, 88000 Uzhhorod, Ukraine
e-mail: ohorlenko@gmail.com

ORCID AND CONTRIBUTIONSHIP

Olesya M. Horlenko: 0000-0002-2210-5503 A E F
Oksana M. Berezovska: 0000-0003-1565-8174 A B C D
Lyubomyra B.Prylypko: 0000-0002-4131-5450 A F
Valeriya V. Brych: 0000-0003-3741-6002 A F
Yana V. Lazur: 0000-0002-7892-4946 A F
Kristian O. Debretseni: 0000-0001-7483-1307 A D
Lyubov A. Halay: 0000-0003-2833-5577 A D

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