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Asthma and pulmonary tuberculosis as comorbidities

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Development of multiple diseases in one patient or comorbidity is currently common in clinical practice [5]. Due to the mutual burdensome effect on the clinical course of both underlying and concomitant diseases, reduced efficacy of treatment of patients with comorbidity is an urgent problem for modern medicine [1].

Such comorbidities include asthma and pulmonary tuberculosis (PTB), which constitute an important medical and social problem, especially for countries where the epidemic of tuberculosis has been officially reported [4, 6]. This is due to their significant prevalence, significant negative impact on working capacity, quality of life, mortality of the population [2, 3]. Despite significant advances in the treatment of asthma and PTB, the combination of these diseases is expected to complicate the treatment process for the respective patient populations and significantly reduce its efficacy. Thus, the presence of asthma in patients with PTB increases the duration of their treatment, decreases the rate of cessation of bacterial shedding and healing the cavities of lung destruction, increases the risk of PTB relapses and complications, contributes to the development of adverse reactions to antituberculosis agents (ATA), which in general worsens the epidemic and social and economic situation associated with tuberculosis [7, 8]. On the other hand, the presence of PTB in patients with asthma contributes to a frequent exacerbations of the latter and loss of control over its course [4, 7, 8]. Thus, the development of a system of measures aimed at timely detection of both asthma and PTB and increase in the efficacy of treatment of such patients and prevention of the exacerbations of asthma and relapses of PTB remains a relevant issue. However, unfortunately, this issue is underestimated by both allergists and pulmonologists and phthisiologists, since only a few publications addressed this problem in the modern literature.

The aim of this study was to determine the incidence of asthma in patients with PTB and the effect of asthma

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on the results of treatment of patients with PTB when it is combined with asthma.

Materials and methods

A retrospective analysis of the medical records of 2,053 patients aged 20 to 60 with newly diagnosed PTB who were on treatment at the State Institution «National Institute of Phthisiology and Pulmonology named after F.G. Yanovsky of NAMS of Ukraine» in 2008–2016 was carried out. The study was conducted at the expense of the state budget. All patients with PTB received ATA, and, in the co-existence of asthma, - the background asthma therapy in accordance with the current protocols. The results of clinical, X-ray, functional, laboratory examinations and collection of the history of allergic disorders of patients were processed and calculated using parametric and non-parametric statistical methods. While processing of the results for each parameter, the mean square deviation, the arithmetic mean (M), and the standard error of the arithmetic mean (m) were calculated. The probability of the difference between the groups in which the data were distributed according to normal law was estimated using the t-test based on the Student table, but if the distribution law was different of the normal according to U-test, - using the paired Wilcoxon-Mann-Whitney test. Data for which p <0.05 were considered as statistically significant. Differences for which p > 0.05 were considered as a trend. The findings of examination and treatment of patients with PTB and concomitant asthma were stored, processed and computed using licensed software products of a package of mathematical and statistical methods using Microsoft Office Professional 2007, license No 43437596.

Results and discussion

The incidence of asthma in patients in PTB over the follow-up years is presented in Table below. Analysis of the data presented shows that during follow-up, asthma was diagnosed in 110 (5.4%) of 2,053 individuals with newlydiagnosed PTB, and its year-wise incidence varied from 2.8 to 7.3%. Of note, in 2015–2016 only a trend in decreasing the incidence of combination of asthma and PTB was recorded (p>0.05 for all cases). At the same time, according to the severity of asthma, the patients were divided as follows: intermittent asthma occurred in 27 (24.5%) patients, persistent mild asthma – in 36 (32.7%) patients, persistent moderate – in 28 (25.5%) patients, persistent severe – in 19 (17.3%) patients. Hence, among patients with PTB, a higher incidence of persistent moderate and severe asthma accounting for 42.8% of cases was recorded. Such a rate of the combination of asthma with PTB was not accidental and fully complies with the comorbidity criteria for two diseases.

When comparing the incidence of presence/absence of destructive lung alterations in patients with or without concomitant asthma, it was found that the cavities of destruction were somewhat more common in patients with asthma (by 7%). However, among patients with asthma with and without acute exacerbations, the proportion of subjects with shedding was approximately the same (51.2% vs. 48.8% of cases, at p < 0.05).

Collection of the history of allergic diseases of patients with asthma and PTB included a skin prick test with major airborne (indoor, pollen, epidermal) allergens. The results of the study showed that sensitization to these allergens was observed in 73 (66.4%) individuals. Thus, hypersensitivity to indoor allergens was diagnosed in 48 (43.6%) subjects, in particular, to house dust allergens – in 28 (25.5%) subjects, to library dust allergens – in 16 (14.5%) subjects, to feather pillow allergen – in 7 (6.4%) subjects. Sensitization to pollen allergens was diagnosed in 19 (17.3%) subjects, and to the epidermal ones – in 4 (3.6%) individuals. Note, that approximately 1/3 subjects (30.9% of cases) had a multiple sensitization to several groups of airborne allergens.

<i>Table</i> Incidence of asthma in patients with PTB in 2008–2016			
Years of follow-up	Number of subjects with PTB	Number of subjects with asthma	
		Abs.	%
2008	257	16	6.2
2009	247	14	5.7
2010	284	17	6.0
2011	164	12	7,3
2012	189	13	6.9
2013	203	11	5.4
2014	211	12	5.7
2015	248	7	2.8
2016	250	8	3.2
Total	2053	110	5.4

Thus, the results of the collection of the history of allergic diseases of patients allowed to prove the role of airborne allergens in the development and progression of asthma in patients with PTB. This fact was also supported by clinical and historical data, since exacerbations of asthma in cases of hypersensitivity to indoor allergens were observed year-round, and in cases of sensitization to pollen allergens, exacerbations of asthma had clear season-dependent nature.

As mentioned above, a combination of asthma and PTB, especially if an acute exacerbation of asthma cause the loss of control over its course, negative effect of asthma on the treatment outcome of patients with PTB should be expected. Thus, after 3 months of ATA in patients without exacerbations of asthma, healing the cavities of destruction was observed in $(44.6\pm6.7)\%$ of individuals vs. (25.3 + 3.8)% of patients with exacerbations of asthma (p <0.05). Such a slower rate of healing in patients with PTB in the setting of asthma exacerbations led to prolonged stay in the hospital. In patients without acute exacerbations of asthma, the average length of hospitalization was (132.1 ± 6.6) days, and in case of exacerbations of this disease – (168.0 ± 4.3) days, that was 36 days longer, at p <0.05

The cessation of bacterial shedding in patients with PTB was more frequently seen in patients without acute exacerbations of asthma and was observed in 2 months of the use of ATA in $(74.3\pm 4.7)\%$ of individuals vs. $(60.2\pm 5.6)\%$ of subjects with exacerbations of asthma, at (p <0.05). And the overall incidence of shedding at the end of the course of tuberculosis treatment was similar.

Therefore, the presence of asthma in patients with PTB, especially when its course is uncontrolled, creates additional difficulties in treating patients with this comorbidity, affecting the results of therapy in this patient population.

Conclusions

Asthma and PTB meet the criteria for comorbidities, as they combine in 5.4% of patients.

Multiple hypersensitivity to the main airborne allergens was observed in the vast majority of patients with a combination of asthma and PTB.

Exacerbations of asthma in patients with newly diagnosed PTB significantly delayed the cessation of bacterial shedding (after 2 months of treatment, a negative reaction of sputum was observed in $(74.3\pm4.7)\%$ of patients without asthma exacerbations vs. $(60.2\pm5.6)\%$ of patients with exacerbations) and healing of the cavity of lung destruction (after 3 months of treatment in patients without asthma exacerbations, scarring of destruction was seen in $(44,6\pm6,7)\%$ of individuals vs. $(25,3\pm3.8)\%$ of those with exacerbations).

Combination of asthma and PTB is an important medical and social problem which requires further research and development of appropriate measures for timely diagnosis, effective treatment, prevention of development and further progression of both diseases.

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