

Analysis of the correlation between level of anxiety, intensity of depression and bronchial asthma control

Tadeusz Pietras¹, Michał Panek², Andrzej Witusik³, Radosław Wujcik⁴, Janusz Szemraj⁵, Paweł Górski¹, Piotr Kuna²

¹Department of Pneumology and Allergology, Medical University of Lodz, Poland

Head: Prof. Paweł Górski MD, PhD

²Department of Internal Diseases, Asthma and Allergy, Medical University of Lodz, Poland

Head: Prof. Piotr Kuna MD, PhD

³Department of Psychology, The Jan Kochanowski University of Humanities and Sciences in Kielce, Branch in Piotrków Trybunalski, Poland

Head: Andrzej Witusik PhD

⁴Faculty of Psychology, Academic School of Social Psychology in Warsaw, Poland

Head: Jerzy Karyłowski PhD

⁵Department of Medical Biochemistry, Medical University of Lodz, Poland

Head: Prof. Jacek Bartkowiak MD, PhD

Post Dermatol Alergol 2011; XXVIII, 1: 15–22

Abstract

Introduction: Somatic and mental disorders are present in patients suffering from obstructive diseases such as bronchial asthma. Physical complaints can induce anxiety and mood disturbances that correlate with worsened quality of life and are considered as very important factors in prognosis of bronchial asthma status. Depression and dyspnoea modify the level of asthma severity according to GINA, the result of the Asthma Control Test, and sensitivity to asthma treatment. Currently, researchers more often than before emphasize the clear role of psychopathological factors in the course of bronchial asthma.

Aim: To assess the correlation between the score in the Asthma Control Test (ACT), in patients with bronchial asthma who were well, partially and poorly controlled, and psychopathological factors.

Material and methods: The study enrolled 167 patients diagnosed with bronchial asthma and 178 healthy people, as the control group. Structuralized anamnesis was obtained and spirometry was performed in compliance with the standards set by the Polish Respiratory Society. Respiratory disturbances and their severity were evaluated according to the GINA Report. All the patients were assessed using the ACT, Beck Depression Inventory and Spielberger State-Trait Anxiety Inventory (STAI). Multiple positive correlations were found between psychopathological factors and the result of the ACT in the group of bronchial asthma patients versus controls.

Results: According to GINA, mild asthma was diagnosed in 24 patients, moderate in 76, and severe disease in 67. Hundred three patients were assessed as poorly controlled (62.2%), 60 partially controlled (35.5%) and 4 well controlled (2.3%). The intensity of depression and the level of anxiety modified the level of asthma severity according to GINA ($p < 0.05$). Depression, anxiety-state and anxiety-trait modified the level of asthma control in the Asthma Control Test (ACT™) ($p < 0.05$).

Conclusions: A positive correlation between psychopathological variables and the result of the ACT was observed in the studied group of patients with bronchial asthma versus the control group.

Key words: bronchial asthma, depression, anxiety, quality of life, Asthma Control Test (ACT).

Introduction

Bronchial asthma is a serious, interdisciplinary medical and psychosocial problem [1]. It affects around 10% of populations in developed countries (United Kingdom 13.85%, Finland 11.0%, Ireland 10.5%, Poland 10.5%, the

Netherlands 8.7%, Switzerland 8.02%, France 6.9%, Spain 5.0%, Germany 4.7%) [2-6]. Chronic bronchitis, with periodically occurring bronchospasms and severe systemic disorders due to hypoxia, is a factor significantly deteriorating the patient's quality of life and can be a cause of

Address for correspondence: Tadeusz Pietras MD, PhD, Department of Pneumology and Allergology, Medical University of Lodz, Kopcińskiego 22, 90-153 Lodz, Poland, tel. +48 42 678 75 05, fax +48 42 678 21 29, e-mail: cital200@wp.pl

mood disorders [7-11]. Unfortunately, the prevalence of mood disturbances in bronchial asthma is not known in detail. The personality traits of subjects with chronic obstructive syndromes have not been defined precisely. It is not clear whether psychopathological variables correlate with the objective parameters of functional pulmonary tests, or whether temperamental traits correlate with the level of bronchial asthma control.

It should be kept in mind that, according to Eysenck's theory, temperamental traits have a biological background [12]. Personality traits are universal, whereas the structure of temperament can be described by means of independent superfactors [12, 13]. On the basis of analyses of the factors determining individual differences of temperament as well as results of psychometric tests, Eysenck identified three factors describing temperament. These variables are often referred to as superfactors, principal or biological dimensions [12-15]. According to the concept proposed by Eysenck, the hierarchic structure of temperament consists of three superfactors: Psychoticism, Extroversion and Neuroticism. They are independent variables, determined by the behavioural factors associated with them [12, 16, 17]. It should be emphasized that the Superfactors Concept developed by Eysenck is closely connected with temperamental determinants of individual differences and according to Kuhn meets the paradigm criteria [12, 18, 19].

The personality traits differ significantly from one another. Eysenck emphasizes the mutual associations between the particular maximal and minimal values of each of the main temperamental factors. The Neuroticism superfactor consists of such traits as anxiety, dejection, depressiveness (depression), sense of guilt, low self-esteem and tension [12, 13, 18, 19]. The biological dimension Extroversion includes the following traits: sociability, liveliness, activity and sensation seeking. The Psychoticism superfactor differs from the two described above. It is closely correlated with pathology, composed of psychotic syndromes, psychopathologies and schizophrenia. According to Eysenck's theory, psychoticism is a dimension which is also associated with other temperamental traits, including altruism, empathy and socialization [12, 13, 18, 19].

It is noteworthy that considerable intensity of anxiety and depressiveness (depression) factors, making up the Neuroticism superfactor according to the Big Five theory and Eysenck's concept [20, 21], is a symptom typical both of a depressive episode and of anxiety disorder [20, 22]. The typical temperamental traits of patients with chronic obstructive syndromes have not been acknowledged so far.

According to Jung, contemporary empirical psychology, which is one of the natural sciences, describes the causes and analyses the structure of pathological variables [23]. Definition and identification of pathological factors, description of the traits leading to limitation of

adaptability, as well as investigation of the elements of the Neuroticism superfactor in the area of thinking and sensation, are the key issues strongly correlated with the patient's emotional state [23]. Analysis of correlations between the psychopathological variables which are components of the superfactors according to the Big Five model and Eysenck's theory constitutes the basis for describing the role of associations between temperamental traits and the clinical condition of patients suffering from obstructive respiratory syndromes [12, 20-22].

Aim

The aim of the study was to analyse the associations between the objective obstruction measures based on spirometry and the intensity of psychopathological variables (anxiety and depression), as well as to determine the correlation between the level of bronchial asthma control and the traits of the Neuroticism superfactor according to the Big Five model and Eysenck's theory. A description of the role of temperamental variables will make it possible in future to gain some insight into the risk factors for the development of mood disturbances in patients with obstructive pulmonary diseases.

Material and methods

The study was carried out in a group of 167 patients with bronchial asthma (mild – 24 patients, moderate – 76 patients, severe steroid-sensitive asthma – 59 patients, steroid-resistant asthma – 8 patients). The mean age of the patients was 50.29 years. The youngest patient was 20, the oldest one 82 years old. Median 52.00. Variance 228.74. SD \pm 15.12. Bias $-$ 0.25. Kurtosis $-$ 0.77. The study enrolled bronchial asthma patients treated in the Lodz Medical University Department of Internal Diseases, Asthma and Allergy and the Specialist Outpatient Department of Pulmonary Diseases at the N. Barlicki Memorial University Teaching Hospital No. 1 of the Medical University of Łódź. The studied patients were in a stable period of the disease, with no exacerbations of dyspnoea, infection, or increased frequency of night awakenings observed during the preceding week. Patients with malignancies were excluded from the study, as well as those with an episode of mood and anxiety disturbances documented on the basis of medical records and ICD-10: F30-39 and F40-49 research criteria, or developed on an organic background (F06.3 and F06.4). If the aforementioned disorders occurred within the period of recruitment, or slightly before it, and were not treated, the patients were assigned to the study group.

The control group comprised healthy subjects meeting all of the following criteria: no history or symptoms of asthma or other pulmonary diseases, no history or symptoms of allergy, no history or symptoms of atopic dermatitis, no history or symptoms of hypersensitivity to

aspirin, negative skin prick tests using the set of the 10 most common allergens, and no first-degree relatives with a history of asthma or atopy. The group of healthy participants of the study (control) consisted of 178 subjects. The mean age was 46.03 years. The youngest patient was 18, the oldest one 80 years old. Median 48.00. Variance 263.00. SD \pm 16.21. Bias 0.05. Kurtosis – 1.08.

The diagnosis of asthma was based on the GINA (the Global Initiative For Asthma) Report Guidelines. The level of asthma severity and control was determined on the basis of the GINA Report Guidelines. All the participants underwent subjective examinations (structuralized anamnesis including, besides the element of subjective examination, the analysis of factors such as gender, obesity, tobacco smoking, duration of bronchial asthma, allergy to house dust mites, animal fur, mould spores and cockroach allergens, hypersensitivity to non-steroid anti-inflammatory drugs (NSAIDs), etc., in order to determine their role in the development of resistance to glucocorticoids, as well as to establish whether they are primary or secondary to genetic factors in character) and objective examinations. The results of pulmonary function tests and allergological tests were obtained from the individual medical records of the patients. If there were no results of spirometry or allergological tests available, such examinations were additionally performed during the recruitment visit.

According to the standards developed by the Polish Society for Pulmonary Diseases, the best result of three spirometry manoeuvres was selected for the analysis of obstructive disorders and disease severity. The correlation analysis took into consideration FEV₁ (forced expiratory volume) expressed in litres, FEV₁% (A/N% – percentage ratio of the measured to expected value) expressed as per cent of the expected value and FEV₁% FVC index (ratio of FEV₁ to FVC – forced vital capacity) expressed as absolute numbers. Spirometry tests were conducted in the Outpatient Department according to ERS (European Respiratory Society) / ATS (American Thoracic Society) standards, and allergological tests according to the guidelines of the EAACI (European Academy of Allergy and Clinical Immunology).

All the subjects were assessed with the Beck Depression Inventory in the version proposed by Pużyński and Wciórka [24, 25]. The results were expressed as scores.

The level of depression was calculated on the basis of the following results scored by the patients: 0-10 points – no depression or mood deterioration; 11-16 points – mild depression; 17-27 points – moderate depression; 28 or more points – severe depression. Anxiety as a trait and anxiety as a state were measured with the Spielberger State-Trait Anxiety Inventory (STAI) in the Polish adaptation developed by Wrześniewski *et al.*, published by the Polish Psychological Association Laboratory of Psychological Testing [26]. The results were expressed as absolute numbers of points scored for answers to the questionnaire. The declared dyspnoea level was estimated according to the 10-degree Borg subjective sensation scale [27]. Each patient marked objective dyspnoea severity at the time of the test on the scale from 0 to 10.

The level of asthma control was assessed with the Asthma Control Test, which is clear and easy for patients. The Asthma Control Test (ACT) consists of five questions. It was developed by Nathan *et al.* in cooperation with general practitioners and specialists in diagnostics and therapy of asthma [28-30]. Bronchial asthma control level was calculated on the basis of the following patients' results obtained in ACT: 0-20 points – no asthma control; 21-24 points – partially controlled asthma; and 25 points – well-controlled asthma.

Correlations between the variables analysed in the study were measured by means of Pearson's linear correlation coefficient, χ^2 test, t-test, Kruskal-Wallis test, Bonferroni test, Levene's variance homogeneity test, and t-test for equality of means. The means, variances, standard deviations and correlation coefficients were calculated using SPSS licensed statistical software package. The differences in mean values were regarded as significant statistically at $p = 0.05$ level.

Results

The following results concerning depression intensity were obtained in the group of healthy subjects without bronchial asthma: no depression or mood deterioration – 68%; mild depression – 19%; moderate depression – 10.5%; severe depression – 2.5%. The results concerning levels of depression in the patient group are presented in table 1. Figure 1 presents the distribution of frequencies of particular depression levels in the groups.

Tab. 1. Depression severity category based on score obtained on the Beck Scale in patients with bronchial asthma classified according to disease severity

Depression level measured according to Beck Scale	Bronchial asthma			
	Mild	Moderate	Steroid-sensitive	Steroid-resistant
No depression or mood deterioration [%]	56.5	50.7	44.8	25.0
Mild depression [%]	26.1	36.0	29.3	37.5
Moderate depression [%]	17.4	12.0	22.4	12.5
Severe depression [%]	0	1.3	3.5	25

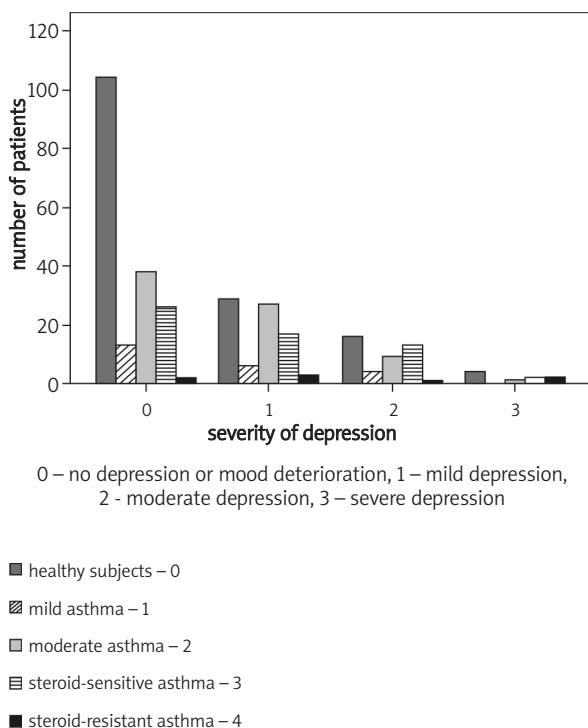


Fig. 1. Correlation between depression severity and bronchial asthma control level (ACT)

Pearson’s χ^2 test demonstrated a correlation between depression and bronchial asthma in controls versus asthma patients ($p < 0.05$). A similar correlation was found on analysis of associations within the studied populations. A strong correlation between the particular depression intensities (no depression or mood deterioration, mild depression, moderate depression, severe depression), and asthma severity was observed at the significance level $p = 0.001$.

No correlation was found between the level of depression and asthma resistant to treatment ($p > 0.05$) or between the level of depression and non-severe and severe asthma ($p > 0.05$).

Depression intensity levels in severe asthma patients are presented in table 2 and illustrated in figure 2. A strong correlation between the levels of depression

Tab. 2. Depression severity in patients with difficult-to-treat bronchial asthma

Depression level measured according to Beck Scale	Difficult-to-treat asthma	
	0 (no)	1 (yes)
No depression or mood deterioration [%]	48.5	47.1
Mild depression [%]	33.8	26.5
Moderate depression [%]	16.9	14.7
Severe depression [%]	0.8	11.8

intensity and difficult-to-treat asthma was demonstrated at $p = 0.01$ significance level.

The mean intensity of anxiety measured with Part X – 1 STAI (anxiety as a state) in the control group was 39.27 (SD ± 10.13), and in the group of bronchial asthma patients 39.64 (SD ± 11.55). The mean intensity of anxiety according to STAI Part X – 2 (anxiety as a trait) in the group of healthy subjects was 43.62 (SD ± 9.00), and in the group of bronchial asthma patients 44.41 (SD ± 9.68). No correlation was observed between anxiety-state and anxiety-trait in controls versus asthma patients, both with non-severe and severe asthma ($p > 0.05$). The analysed correlations are presented in figures 3 and 4.

The correlations between asthma control level measured with ACT and depression severity were analysed. The obtained results are presented in table 3. Pearson’s χ^2 test demonstrated a strong correlation between the loss of bronchial asthma control and intensity of depression at $p = 0.01$ significance level. Mood deterioration and increasing severity of depression were observed in the analysed groups as the number of asthma symptoms increased (growing severity of dyspnoea, impairment of everyday functioning at home/work/school, night and early morning awakenings, frequent administration of bronchodilators, self-assessment of asthma control by the patient), which is illustrated in figure 5.

The effect of anxiety level (anxiety as a state and anxiety as a trait) on the level of bronchial asthma control (ACT) was assessed in the studied groups. The level of the variable in the patient population is presented in table 4. Multiple comparison analysis was conducted using Bonferroni test. A number of significant, both inter- and intra-

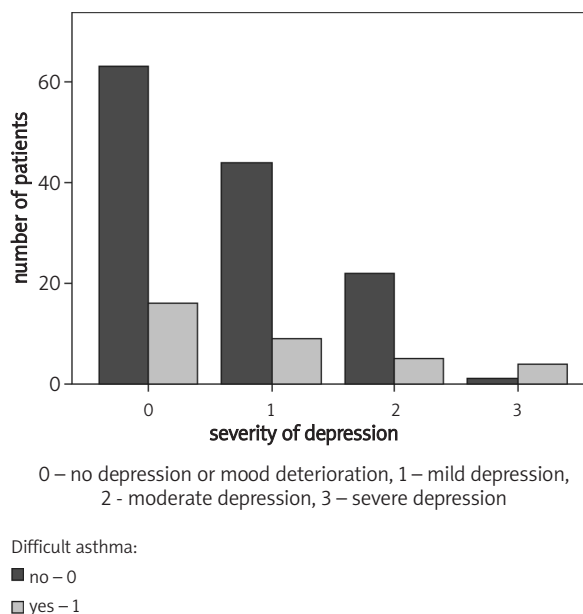


Fig. 2. Analysis of correlation of depression severity in patients with difficult-to-treat asthma

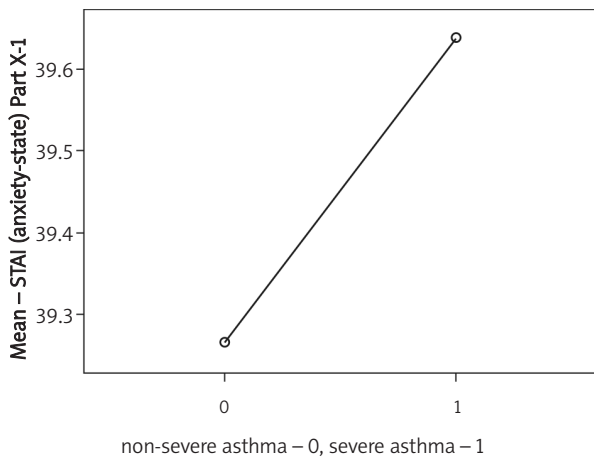


Fig. 3. Analysis of correlation between anxiety as a state (STAI Part X-1), non-severe and severe bronchial asthma

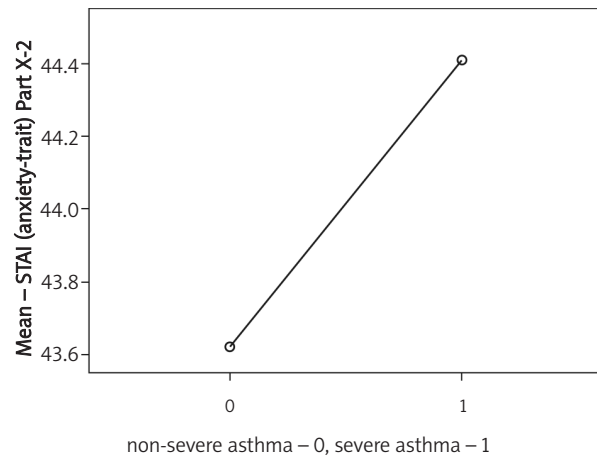


Fig. 4. Analysis of correlation between anxiety as a trait (STAI Part X-1), non-severe and severe bronchial asthma

group, correlations were demonstrated. A statistically significant correlation was found between anxiety as a state and uncontrolled and partially controlled asthma ($p = 0.016$). Anxiety as a trait in patients with loss of asthma control in the groups of patients with partially ($p = 0.004$) and well-controlled asthma ($p < 0.0001$). The obtained results are presented in figures 6 and 7.

Discussion

As emphasized by epidemiological studies, the coincidence of a somatic disease with mood and anxiety disorders is associated with a worsened course of the underlying disease, progression of symptoms and the need for more frequent medical consultations [31]. Such observations were made as early as the 1950s by Franz Alexander, who classified bronchial asthma as a psychosomatic disease. The occurrence and course of such diseases have a significant association with the patients' mental functions and demonstrate strong correlations with psychopathological variables [32, 33]. The inflammatory aetiology of bronchial asthma leads to dyspnoea episodes experienced by the patients, which consequently leads to the activation of physiological mechanisms inducing mood deterioration and anxiety [6, 34].

The GINA Report 2006 states that despite the developed treatment standards and implementation of modern bronchodilating agents and anti-inflammatory drugs, even as many as 50% of patients received incorrect treatment. The lack of control of the disease was due to non-compliance with the recommended therapy by the patients and introducing their own modifications to the used treatment [1, 4, 6, 33]. Studies by Vila and Huovinen demonstrated that the disease leads to lower self-esteem of the patients, reduces their social competences, deteriorates the ability to cope with asthma, and induces gen-

Tab. 3. Depression severity in patients according to bronchial asthma control level

Depression		Asthma control test (ACT)		
		0-20 points	20-24 points	25 points
		1	2	3
Depression severity or mood deterioration	no depression	49.4%	45.9%	4.7%
	mild	68.5%	31.5%	00.0%
	moderate	82.1%	17.9%	00.0%
	severe	100.0%	0.0%	00.0%
Total		62.2%	35.5%	2.3%

eralized emotional disturbances and anxiety [34-36]. Anxiety and mood disorders accompanying obstructive diseases induce a feeling of existential threat. Anxiety as a state may modify anxiety-trait, which predisposes to reactions with anxiety as a state, which enhances the subjective sensation of shortness of breath and other symptoms [20, 34, 37]. Studies by Bateman *et al.* confirm the phenomenon of impossibility to achieve satisfactory control of symptoms in all patients with bronchial asthma despite modern methods of treatment [38, 39]. Among the factors contributing to ineffective asthma treatment, attention should be paid to lack of cooperation with physicians on the patients' part, non-acceptance of the disease, necessity of chronic administration of drugs, delayed diagnosis of asthma, tobacco smoking and patients' disappointment with contacts with health care personnel [1, 34]. The disease-related variables listed above markedly deteriorate the patients' quality of life and support, prolong asthma attacks and increase hospitalization time.

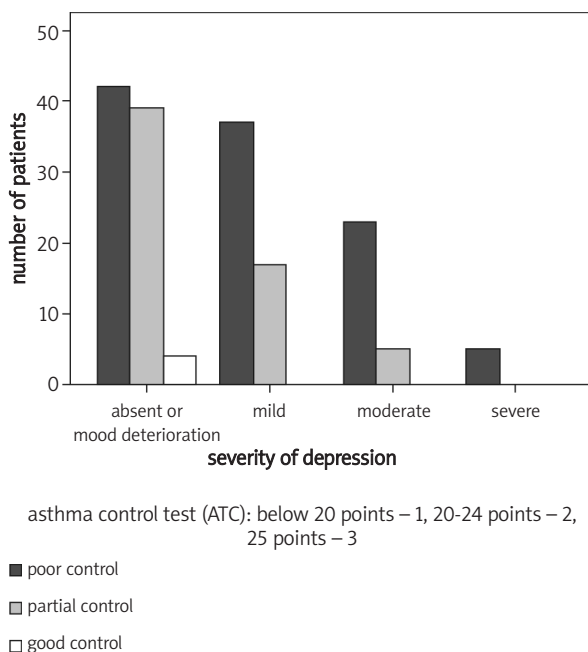


Fig. 5. Depression severity and loss of control over bronchial asthma measured with ACT

From the clinical point of view, the study demonstrated important correlations between the level of asthma control (ACT), and the anxiety level and depression intensity. The results of the study confirmed that the analysed psychopathological variables significantly influence the level of disease control. It should be emphasized that a satisfactory level of control of asthma symptoms was not found in any of the patients in the severe asthma group. Worse bronchial asthma control had a negative influence on the patients' quality of life, which caused secondary aggravation of mood deterioration. This correlation was less pronounced in patients with mild and moderate asthma.

In recent years, attention has been paid to the association of the patients' mental state (depression, anxiety-state, anxiety-trait) with the symptoms of bronchial asthma,

the dynamics of its course and treatment efficacy (ACT). The emotional factor is undoubtedly an important mechanism supporting the attack of dyspnoea. The observations made by Holgate demonstrated an association of emotional excitation with hyperventilation in the mechanism of central respiratory pattern generator activation [44]. The results obtained in the present study confirmed the correlation of the emotional component with asthma severity. Psychological factors also play a key role in patients' ability to cope with a somatic disease. In this context, the studies concerned with personality traits which can significantly modify the functioning of the patients are justified. The analysis of temperamental variables by means of psychological tests assessing the patients' abilities to cope with difficult and stressful situations, as well as the functional role of personality in the process of the patient's adaptation to the disease, is an important element making it possible to precisely identify the factors affecting behavioural disorders and loss of control over bronchial asthma. In future, it will allow psychological aspects to be included in the tests assessing the level of asthma control in addition to the occurrence of symptoms and results of respiratory function tests.

This paper, in accordance with the applicable biopsychosocial paradigm, confirms that bronchial asthma should be treated as a psychosomatic disease. The psychological factor is considerably involved in the aetiopathogenesis and clinical presentation of the disease [40]. The attacks of dyspnoea are accompanied by a high level of anxiety and mood deterioration.

The present study indicates the need for holistic care to be provided to patients with bronchial asthma and coincident mood and anxiety disturbances. From the point of view of methodology, a clinical psychologist and a consulting psychiatrist play an important role in the diagnostics and therapy of patients with bronchial obstruction. The treatment of depression and anxiety disorders in the course of chronic pulmonary diseases should include not only administration of antidepressants, but also psychotherapeutic management [20, 37, 41-43].

Tab. 4. Level of anxiety in bronchial asthma patients and level of disease control (ACT)

Anxiety	Asthma control level (ACT)	M	SD	SE	95% confidence interval for the mean		Min.	Max.
					lower limit	upper limit		
Anxiety-state	poorly controlled	41.09	11.20	1.08	38.95	43.24	21	74
	partially controlled	36.38	9.01	1.15	34.07	38.68	21	58
	well controlled	29.25	9.17	4.58	14.64	43.86	21	41
Anxiety-trait	poorly controlled	45.83	9.02	0.87	44.10	47.56	24	64
	partially controlled	41.31	8.18	1.04	39.21	43.41	26	61
	well controlled	28.75	6.13	3.06	18.99	38.51	21	35

M – mean for the test, SD – standard deviation, SE – standard error

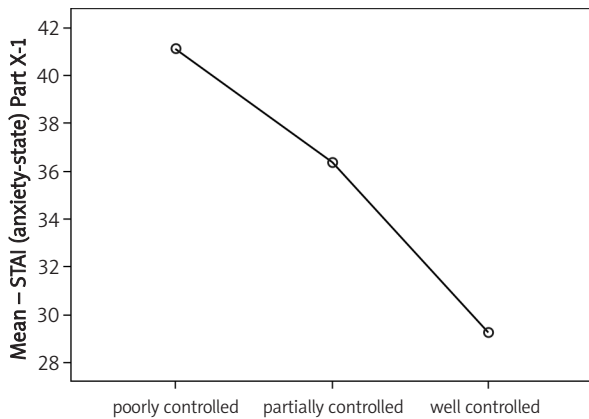


Fig. 6. Correlation between anxiety as a state and bronchial asthma control level (ACT)

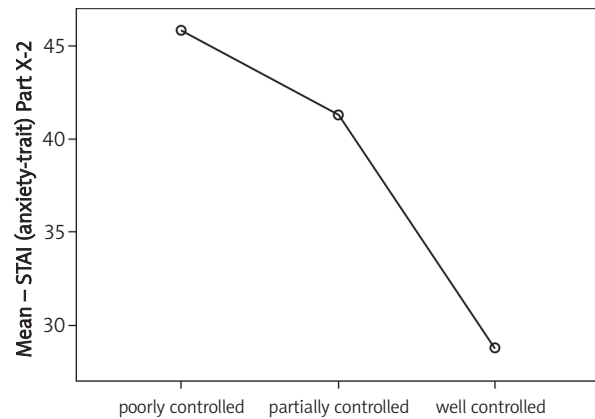


Fig. 7. Correlation between anxiety as a trait and bronchial asthma control level (ACT)

Conclusions

It should be emphasized that precise determination of temperamental traits in bronchial asthma patients is a key problem for assessment of the patients' phenotype. It will make it possible in future to establish a profile of Polish patients. Screening conducted from the point of view of prognosis will provide the possibility of early diagnostics of coincident mental disorders. Early identification of patients with bronchial asthma accompanied by mood and anxiety disturbances will allow appropriate psychosomatic therapy to be instituted.

Precise specification of personality traits in patients with obstructive syndromes may in future allow the identification of common genetic factors predisposing to the development of depression, excessive activation of proinflammatory cytokines and chronic hypoxia at the level of the central nervous system. Identification of genetic variables with institution of early and, from the very beginning, intensive treatment of bronchial asthma will not only ensure better control of the pathological process, but also provide secondary prevention of mental disorders and may contribute to the development of appropriate interdisciplinary standards of management in future.

This study is a preliminary analysis of the selected Superfactors according to the Big Five model and Eysenck's theory. Determining the correlation between psychopathological variables and formal aspects of behaviour including energetic and temporal characterization is, in view of the present study and obtained results, an important element of multidimensional diagnosis and holistic therapy of bronchial asthma patients.

Acknowledgements

The study was partially financed from Grant No. N N402 374638 of the Ministry of Science and Higher Edu-

cation of the Republic of Poland received by Michał Panek, MD and Prof. Piotr Kuna.

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