

ANTIINFLAMMATORY EFFECT OF HIGH-ALTITUDE ADAPTATION IN PATIENTS WITH BRONCHIAL ASTHMA¹

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SUMMARY: During some years we have already elaborated the method of high-altitude climatothrapy (HACT) in patients with bronchial asthma (BA) (on the Tuya-Ashu Pass, Northern Tien-Shan, 3,200m above the sea level). Complex bronchologic study including bronchoalveolar lavage (BAL) was performed in 62 patients with BA before treatment (in Bishkek, 760 m above the sea level) and on the 25th day of HACT. BAL study included: cytologic composition, estimation of the viability and phagocytic activity of alveolar macrophages (AM) with latex particles, immunoglobulinFc- and complement C₃-fraction receptors on AM membrane, assessment of secretory IgA (SIgA) and surface activity (SA) of surfactant. We found that the treatment of patients with BA at high-altitude to improve a number of parameters of BAL demonstrating the antiinflammatory effect of high-altitude climatothrapy.

Key words: Bronchial asthma, high-altitude climatothrapy, bronchoalveolar lavage, cytology, SIgA, surface, activity.

INTRODUCTION

The climatic treatment of asthma by sojourns in the mountains has been prescribed since many years (M.M.Mirrahimov, 1977; H. Razzouk, 1988), but the majority of mountain medical centres devoted to climatic treatment of asthma are situated at middle altitude ranging from 1000 to 2000 meters. Presumably the highest one is the Tuya-Ashu Sanatorium situated at 3200 meters above sea level in the Northern Tien-Shan mountains (Kyrgyzstan). For several years we have already elaborated the method of high-altitude climatothrapy (HACT), in patients with bronchial asthma (BA) on this scientific base. Our study was aimed at the investigation

RESUMEN: Durante muchos años hemos elaborado el método de climato-terapia de altura en pacientes con asma bronquial (en la Tuya-Ashu pass, Northern Tien-Shan, 3200 m). El estudio broncológico complejo que incluye el lavado bronquio-alveolar fue realizado en 62 pacientes con asma bronquial antes del tratamiento (en Bishkek, 760 m) y a los 25 días de climato-terapia en la altura. El estudio de lavado alveolar incluyó, la composición citológica, la estimación de la viabilidad y actividad fagocítica de los macrófagos alveolares con partículas de latex, receptores de membrana de los macrófagos alveolares de la fracción del complemento C₃, y Fc de la inmunoglobulina, determinación de la IgA secretoria, y la actividad de superficie del surfactante. Se encontró que la altura como tratamiento del asma bronquial mejora una serie de parámetros del lavado bronquial demostrando que la altura tiene un efecto anti-inflamatorio.

Palabras claves: asma bronquial, climato-terapia de altura, lavado bronquio-alveolar, citología, IgA, actividad de superficie.

the local defense mechanisms of bronchial tree during HACT.

MATERIAL AND METHODS

Complex bronchologic study (with OLYMPUS bronchofiberscope) including bronchoalveolar lavage (BAL) was performed in 62 patients with BA before treatment (in Bishkek, 760 m above sea level) and on the 25th day of HACT. As a control group we investigated 8 healthy men at age 17-19 years. BAL study included: cytologic composition, estimation of the viability and phagocytic activity of alveolar macrophages (AM) with latex particles, investigation of immunoglobulin Fc- and complement C₃-fraction receptors on AM membrane by EA-

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and EAC-rosette-forming tests, assessment of secretory Ig A (SIgA) and surface activity (SA) of surfactant.

METHOD OF HIGH-ALTITUDE CLIMATOTHERAPY: after the baseline examination in Bishkek (760 m above the sea level) the patients were transported by bus to the high-altitude sanatorium of the Kyrgyz Institute of Cardiology which is situated in the Tuya-Ashu Pass (Northern Tien-Shan, 3200 m above sea level). During the first 5-7 days of adaptation the patients were recommended to follow the limited exercise regimen in order to mitigate the course of acute mountain sickness. The patients were allowed to increase gradually the exercise activity and they were administered exercise therapy and mountain tracking (N.Brimkulov, 1991). Repeated examination was performed on the 25th day of high-altitude climatotherapy.

RESULTS

Our studies demonstrated (Table 1), that lowlanders with BA had decreased concentration of AM in BAL. Lavage liquid cellular content included a great number of neutrophils typical of chronic bronchial inflammation, and eosinophilia that is the evidence of allergic genesis of the disease. High-altitude adaptation resulted in clinical improvement manifested in the increase of the concentration and viability of AM and significant decrease of neutrophile and eosinophile count, these changes were the evidence of local defensive mechanism activation and bronchial allergy inflammation reduction.

Phagocytic activity of AM in patients with BA at low altitude was decreased and integral phagocytic index was also reducing accordingly. During adaptation, the test parameters significantly increased. AM are known to include the receptors for immunoglobulins and complement that stimulate phagocytosis.

Immunoglobulin Fc- and C₃- complement receptors investigation on AM membrane revealed the decrease of these values at low altitude and their significant increase following high-altitude adaptation.

A number of papers demonstrated the presence of secretory Ig A in BAL which pro-

tests mucous membranes from bacteria and viruses. Secretory Ig A concentration in BAL in patients with BA at low altitude was decreased however, after high-altitude climatotherapy it was significantly increased. The Stability Index of BAL in response to high altitude climatotherapy increases also.

Table 1. Changes in cytology of BAL, alveolar macrophage functional activity, SIgA and stability index of BAL in patients with BA during HACT (M±SD).

Parameters	Control group	Patients With asthma	
		Baseline	On 25th days of HACT
Neutrophils, %	5,2±1,1	25,4±2,46*	8,1±1,16**
Eosinophils, %	0,9±0,2	20,0±2,93*	5,3±1,62**
Lymphocytes, %	3,0±0,7	6,3±1,31*	2,3±0,46**
AM, %	90,5±1,3	48,3±4,31*	84,4±1,62**
AM viability, %	95,0±2,2	64,8±6,70*	90,3±2,16**
Phagocytic index, %	26,2±3,6	16,2±1,62*	47,4±2,77**
EA-rosette-forming AM, %	64,5±3,1	18,8±2,27*	32,4±2,27**
SIgA, g/L	-	0,2±0,02	0,6±0,03**
Stability index (SI)	1,61±0,1	0,8±0,06*	1,1±0,08**

AM: Alveolar macrophages

* p < 0,05 compared with control,

**p < 0,05 compared with baseline.

DISCUSSION

Our clinical data demonstrated the beneficial effect of high-altitude adaptation and its potential for the treatment of BA patients. In our previous investigations (N.Brimkulov, 1991) it was already demonstrated that during high-altitude climatotherapy in BA patients besides the decrease in dyspnea severity and number of asthmatic attacks, significantly improved bronchial permeability, decreased bronchial hyperactivity and increased cortisol level in blood plasma. In this investigation we found, that severity of inflammatory changes in bronchial

tree decreased while the number of alveolar macrophages in lavage liquid increased and the number of neutrophils and eosinophiles reduced. All these changes evidently allow to stabilize the conditions in the most BA patients.

Probably, it was due to the hypoxic stimulation of adrenal cortex and the improvement of the patients' condition was achieved. Also noteworthy are other sanogenic factors of high-altitude climate: purity of the air, the absence of the environmental allergens, high air ionization and insolation (M.M.Mirrakhimov, 1977; H.Razzouk, 1987; D.Charplin et al., 1988).

Thus, the treatment of patients with bronchial asthma at high-altitude results in the improvement of a number of parameters of BAL demonstrating high-altitude climatotherapy efficacy with evidence of local defense mechanism activation and bronchial allergy inflammation reduction. Using the bronchologic study

including BAL can relieve to evaluate the efficacy of high-altitude climatotherapy. Applying the mutual bronchological investigation on altitudes from 3000 to 3500 m is safely and can be recommended for diagnosis and treatment.

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