

IMMUNOLOGIC PROGNOSIS OF ACUTE MOUNTAIN SICKNESS¹.

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SUMMARY. In the persons predisposed to AMS, a reduction of EHC-rosette-forming cells (E-RFC), T-helper cells, a reduction of monocyte and neutrophil capacity for adhesion, an inhibition of C₃ - and Fc-receptors on the monocytic membrane, and an increase of O-cells level were observed.

Key words: Immunology, Acute Mountain Sickness, T-cells, monocytes, neutrophils, lymphocytes.

RESUMEN. En las personas predispuestas al mal de montaña agudo se observan, una reducción de EHC- células formadoras de rosetas (E-RFC), células T salvadoras, la reducción de monocitos y capacidad de los neutrófilos para la adhesión, la inhibición de C₃- y receptores Fc en la membrana, aumento de células O.

Palabras claves: Inmunología, Mal de Montaña Agudo, Células T, Monocitos, Neutrófilos, Linfocitos.

INTRODUCTION

The development of acute mountain sickness (AMS) is one of the common complications occurring after a short-term exposure to high altitude. In contrast to a favourable course of adaptation (FCA), AMS is characterized by a marked impairment of T- and B- related immunity (Mirrakhimov et al. 1986) and deep inhibition of mononuclear phagocyte system (Kitaev and Goncharov, 1987). In such patients immunodeficiency persists as long as 5 months after remission of clinical symptoms (Mirrakhimov et al. 1989).

The selection of persons for work under high altitude conditions is known to be based on the estimation of the functional state of the organism gas transporting systems (cardiovascular, respiratory system, red blood cells). However, the status of the immune system, which also contributes to the "adaptation cost", has not been taken into account.

The objective of the present work was to retrospectively study the dependence of AMS development on the initial immunologic background of persons adapting to high altitude.

METHODS

Immunologic observations were made at 1500 m above sea level (Gulcha settlement) before the ascent to high mountains.

The subjects were 421 practically healthy men, aged 18-20 years, divided into two groups according to their pattern of adaptation to high mountains of Easter Pamirs (3600 m above the sea level). The first group included 342 men with a favourable course of adaptation, the second comprised 79 men who developed mild to moderate AMS after 3 days exposure to high altitude. The diagnosis was made on the basis of the typical clinical picture (headache, dizziness, ear noise, marked breathlessness and cardiac palpitation on physical exertion or at rest, bleeding sickness, marked diffuse cyanosis, nausea, vomiting), and it was considered to be definite whenever the symptoms characteristic of this sickness persisted for at least 3-5 days.

Peripheral blood T- and B- lymphocyte testing included determination of E- and EHC-rosette-forming cells (RFC), T-helper cells and T-suppressor cells (Jondal et al. 1972; Mendes et al. 1973; Pichler et al. 1978). The T-lymphocyte functional status was judged upon the blast

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transformation reaction (BTRL) with PHA (Samoilina, 1970). The functional evaluation of B-lymphocytes was made according to the level of serum immunoglobulins A, M, and G (Mancini et al, 1965). Furthermore, O-cells were counted (Froland and Natvig, 1973). In addition to this, phagocytic activity of monocytes and neutrophils with latex particles was studied by means of phagocytic index (IPI). EA and EAC-rosette-forming monocytes (RFM) were estimated for revealing receptors to complement C₃ fraction and immunoglobulin Fc-receptors on the monocyte membrane (Sokolov and Rendel, 1983).

RESULTS AND DISCUSSION

In this retrospective study of some peculiarities of adaptation to high altitude (3600 m) depending on the initial immunologic background in persons with AMS, a reduction of absolute and relative content of E-RFC and T-helper cells and the increase of O-cells in peripheral circulation were revealed at 1550 m above sea level (Table 1).

Table 1.- Background Profile of the immune status in patients with Acute Mountain Sickness (AMS) and subjects with FCA prior to ascent to Eastern Pamirs (3600 m).

: Initial data (1550 m)				
Indices	:	Patients AMS	Healthy FCA	P
E-RFC %		59,6 ± 2,4	63,3 ± 3,7	<0,05
BTRL with PHA%		73,6 ± 2,5	71,2 ± 1,3	>0,05
T-Helper cells%		40,4 ± 1,3	47,2 ± 0,9	<0,05
T-suppressor cells %		7,9 ± 0,4	6,4 ± 0,2	>0,05
B-RFC%		16,8 ± 1,4	13,7 ± 1,5	>0,05
O-lymphocytes		23,2 ± 0,3	15,6 ± 0,2	<0,05

These data reveal that in persons predisposed to AMS, inhibition of thymus-dependent immunity link takes place. Besides,

these persons show a reduction of monocyte and neutrophil with latex particles capacity for adhesion and inhibition of C₃ - and particularly Fc-receptors expression on the monocyte membrane (Table 2). Shifts of this kind lead to a negative effect on the adaptation process, they were revealed in 75 % of the persons predisposed to AMS, and they may serve as a valuable diagnostic criterium in selecting people for work in the mountains.

Table 2.- Background Profile of monocytes and neutrophils functional activity in patients with Acute Mountain Sickness (AMS) and persons with FCA prior to ascent to high mountains of Eastern Pamirs (3600 m).

Initial data (1550 m)				
Indices	:	Patients AMS	Healthy FCA	P
monocyte PI %		27,2 ± 2,9	33,0 ± 2,4	<0,05
monocyte PN		1,7 ± 0,1	1,8 ± 0,1	>0,05
monocyte IPI		0,5 ± 0,09	0,6 ± 0,06	<0,05
neutrophil PI %		47,5 ± 1,1	52,2 ± 1,3	<0,05
neutrophil PN		4,7 ± 0,2	5,1 ± 0,1	>0,05
neutrophil IPI		2,3 ± 0,1	5,2 ± 0,1	<0,05
EA - RFM		31,6 ± 0,6	36,6 ± 0,9	<0,05
EAC - RFM		37,2 ± 0,8	46,2 ± 0,9	<0,05

Our previous studies demonstrated the development of a specific immunodeficiency status in AMS, that was marked by deeper disturbances in the immune system compared to the persons with FCA (Mirrakhimov et al. 1986; Kitaev and Goncharov, 1987; Mirrakhimov et al.). Patients with AMS showed T- and B-lymphopenia, the reduction of T-lymphocyte blast transformation under the influence of PHA, reduction of T-cells helpers content, and deep inhibition of phagocytic activity of monocytes and neutrophils. These changes in the immune system persisted from 1-1,5 to 5 months.

The mechanism of immunodeficiency development in AMS is likely to be related to

some latent defects in the immune system, which under the extreme high altitude hypoxia conditions express themselves in a marked and severe disbalance in the immune system.

Thus, the immune reactivity reduction in background predicts issues a negative influence on the adaptation process at high altitude and it should be taken into consideration when selecting people for work in the mountains and for prognosis of some possible disadaptation pathology.

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