DETECTION OF CRYPTIC DESADAPTATION IN WORKERS CONTACTING WITH CHLOROPHENOLS BY STATISTICAL ANALYSIS OF IMMUNOLOGICAL INDICATORS

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Introduction

Chlorophenols (CP) are toxic both themselves and particularly after their conversion into dioxins by oxidation. However, the physiological compensation keeps up a capacity for work and masks the clinical symptoms. Such situation, the so-called "cryptic desadaptation", must be revealed for a correction by means of medical, hygienic and technological measures.

The immune system plays a leading role in homeostasis maintenance, therefore a laboratory examination in immunological state may serve as a diagnostic way for desadaptation detecting. Unfortunately, some causes aggravate obtaining statistically reliable data.

First, the number of probands in each examined group is limited owing to diversity of labour conditions and individual age, length of service etc.

Second, the immune system is regulated with the help of many direct and reverse ways, therefore individual manifestations depend on various factors such as genetic, psychosomatic, chronobiologic ones etc. That gives a wide range of "normal values" - see Table 1.

Third, some immunological indicators are counted up by subjective methods, for example, in visual microscopy and also by precipitation and agglutination methods. Such a problem has great importance for statistical analysis therefore it was investigated upon a special modelling group (see further).

Thus, detection of cryptic desadaptation by statistical analysis of immunological indicators has many difficulties. We have tried to circumvent them by using a special approach to variance analysis.

Material and Methods

Assay methods were described earlier (1). The statistical criteria were calculated according to V.Urbakh handbook (2). Probands characteristics are given further.

Results and discussion

Immunological assays reproducibility was evaluated by examination of workers from a mining factory located at a small town. They had been contacting with an increased quantity of mercury from occupational and environmental sources. This circumstance served as a reason for clinical and laboratory examination which was carried out twice, during three weeks, each with a three-month interval. In the beginning, 115 people aged 30-50 with the length of service equal to 10-15 years were examined. Despite of toxic pressing and increased content of mercurates in body (3), the probands did not have any specific and clearly expressed health disturbances. Some therapeuti-

cal measures corresponding to concrete symptoms of digestive, respiratory, excretory and other disbalances were taken.

The repeated examination of the group consisting of the same 94 people was carried out. The data displayed in Table 1 (columns MG-1 and MG-2) show sufficient reproducibility of the most part of assays, except NTB and IgM indicators. This conclusively allows these methods to be used in the following investigation.

Basic group examination

This group included 50 wokers of "Khimprom" association (Ufa, Russia) aged 30-50. Each proband had been contacting with CP at his work station in the course of 10-15 years. These probands had been permanently observed at the factory ambulatory. None of them had any clearly expressed pathology.

Each proband was treated with preparation "Oxymetacil" which stimulates the immune response like other various pyrimidine bases (4). Drug dose was 0.3 g thrice a day during three months that gave the integral dose of about 70 g. The immunological indicators were obtained twice before and after the treatment (see BG-1 and BG-2 columns in table 1). These data show a considerable difference between the starting and final indicator values in 9 tests from 12. The cell subpopulations and immunoglobulin isotypes gave particulary expressed alterations which could be dependent on drug action.

Table 1

Immunological indicators of "modelling" (MG) and "basic" (BG) groups (see the text).
Mean arithmetic (M) ± mean square deviation (d). tp - Student' criterion

Indicators	NORMAL value	M ± d		tp *	M ± d		tp *
		MG - 1 (n = 115)	MG-2 (n = 94)		BG-1 (n = 50)	BG-2 (n = 50)	
Lymphocytes, % T	60.0 - 75.0	64.0 ± 1.03	64.0 ± 0.95	0	72.55 ± 1.37	65.64 ± 1.82	3.0
B	4.0 - 25.0	15.0 ± 0.64	16.0 ± 0.79	1.0	14.6 ± 1.13	8.77 ± 0.57	4.6
O (null)	0 - 25.0	21.0 ± 1.13	20.0 ± 1.12	0.63	11.6 ± 1.4	25.9 ± 0.19	10.14
H (helpers)	49.0 - 54.0	40.0 ± 1.18	39.0 ± 1.22	0.59	43.3 ± 1.5	37.7 ± 0.28	3.5
S (supressors)	12.0 - 17.0	23.0 ± 1.1	25.0 ± 1.21	1.25	29.5 ± 1.73	29.1 ± 0.21	0.23
Phagocytes: Latex Test [1]	50.0 - 65.0	66.0 ± 1.2	64.0 ± 1.47	1.05	53.38 ± 1.77	49.74 ± 0.37	1.12
NTB sp [2]	0.4 - 0.7	0.66 ± 0.024	0.78 ± 0.03	3.16	0.5 ± 0.028	0.44 ± 0.003	2.1
NTB act [3]	0.85 - 1.1	0.89 ± 0.033	0.98 ± 0.031	2.0	0.68 ± 0.012	0.62 ± 0.005	4.6
Circulating immunocomplexes, U	up to 110 U	45.0 ± 2.89	38.0 ± 2.75	1.75	84.4 ± 6.91	57.4 ± 0.38	3.9
Immunoglobulins.gram per litre.IgM	0.79 - 1.57	1.24 ± 0.052	1.45 ± 0.06	2.62	1.7 ± 0.091	1.07 ± 0.007	7.0
IgA	1.39 - 3.7	3.69 ± 0.13	3.24 ± 0.13	2.44	2.9 ± 0.14	2.01 ± 0.013	6.36
IgG	10.0 - 18.0	27.03 ± 0.55	25.05 ± 0.55	2.47	17.0 ± 0.038	11.35 ± 0.073	68.9

Legend: 1 - Number of cell with internalized latex, %; 2 - Internalization of Nitrotetrazolium blue, Spontaneous, in conditional units; 3-the same after activation by Ps. aeruginosa toxin. * $p<0,001$ double and $p<0,05$ single underlined

However, these results did not give any possibility to interpret the physiological meaning of observed phenomena because the arithmetic mean (M) of all indicators did not exceed the limits of "physiological range". On the other hand, it is remarkable that the most part of Student' criteria in the basic group is higher than that in the modelling group. This impelled us to compare the obtained results by variance criteria.

The conducted analysis (see Table 2) gives a convincing demonstration of inadequate state of probands in different groups. The accumulative indices such as a sum of corresponding criteria give a particularly contrasting information. Although this method is non-traditional, but its usage is admissible because each variation coefficient V and also Fisher' criterion reflect the quality of a concrete stage in immune response. It is evident that a disturbance in any point of the common immune network induces a reply in some other point by means of cascade and mutually connected reactions. As a result, such statistical sensors increase the analysis efficiency despite of the formality of this approach.

Table 2

Variance criteria of "modelling" and "basic" groups.
The abbreviations are in Table 1. V - variation coefficient, F - Fisher' criterion

Indicators	MG			BG		
	V1, %	V2,%	F	V1,%	V2, %	F
Lymphocytes: T	1.7	1.42	1.15	1.88	2.77	1.36
B	4.3	4.94	4.7	7.74	6.5	4.0
O	6.2	6.25	1.1	12.07	0.73	54.4
H	3.5	3.8	1.3	3.46	0.74	28.7
S	5.3	5.8	1.54	5.86	0.72	6.78
Phagocytes: LT	1.8	2.3	2.5	3.31	0.74	22.8
NTB sp	3.64	3.85	1.7	5.6	0.68	87.1
NTB act	3.7	3.2	1.2	1.76	0.81	5.76
CIC	6.4	7.2	1.2	8.19	0.69	330.67
IgM	4.2	4.1	1.2	5.35	0.65	166.0
IgA	3.5	4.0	1.15	4.83	0.65	115.3
IgG	2.0	2.2	1.0	0.22	0.64	3.69
Accumulatve indices	46.2	48.8	18.4	60.2	16.1	826.8

It is known that variance criteria characterize a homeostatic power of organism i.e. its counteraction against exogenic and endogenic pressors (2). This phenomenon has a general biological significance. For instance, a special "homeostatic index" gives the possibility to breed plant strains with improved resistance to climatic stresses. However, in contrast to experimental plant or animal populations, a representative extract of people cannot be formed so easily. It is highly heterogenous and that gives some limitations in principle (see Introduction). The suggested approach minimizes these difficulties and gives a possibility to analyse some objects with insufficient number of people in a selected group.

Thus, relatively isolated population from a small town with restricted migration exchange with other settlements has less variability of immunological indicators in comparison with open population from a big city (basic group). This result may reflect a microevolution of a human collective in living and occupational selection that results in "population drifting". So, adaptability to dangerous factors (for example, to mercury in the modelling group) can be improved by means of population genetic mechanisms.

Another efficacious way for adaptability improvement is body state correction with some drugs.

Conclusion

Our results show that "Oxymetacil" preparation has an "adaptogen" - like activity. This substance from plant sources normalize a lot of functions due to reparation of injured cell membranes. This promotes the proton transfer across them and increases the yield of macroergic phosphates as a result. In such a way the tissue hypoxy which accompanies practically all diseases is diminished. It is important, that adaptogenes do not act on normal cells even by very high doses therefore they may be useful for the improvement of a sanitary state of work collectives simultaneously with their adaptability increasing. This problem is a matter of current interest, especially for persons contacting with CP and probably with dioxins which can cause a prolonged and cryptic desadaptation.

References

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