of thymic humoral factors, which according to Small and Irainin [11] is responsible for regulation of suppressor activity of T lymphocytes. Thymectomy on adult donors is in fact followed by their becoming capable of inducing a GVHR in a syngeneic recipient [4]. The appearance of activity in GVHR induction by spleen cells of donors treated with large doses of hydrocortisone can be attributed to elimination of cells with suppressor activity by the hormone and to a relative increase in activity of lymphocytes which participate in processes of immunologic recognition. Just as in reactions in an allogeneic system [2, 6], suppressor T lymphocytes modulating processes of recognition of autoantigens, are evidently sensitive to hydrocortisone. Population changes connected with a decrease in suppressor activity may perhaps take place in connection with age changes in the pituitary-adrenal system, either acting directly on lymphocytes or leading to age involution of the thymus [9], the role of which in the development of autoimmune pathology is no longer in dispute [10]. It can be tentatively suggested that clones of lymphoid cells responding to autoantigens exist in the body, but under normal conditions their function is inhibited by the activity of hydrocortisone-sensitive suppressor cells.

LITERATURE CITED

1. D. N. Mayanskii and A. N. Meilikhova, Byull. Éksp. Biol. Med., No. 3, 338 (1976).
2. A. Altman and J. R. Cohen, J. Exp. Med., 142, 790 (1975).
3. F. H. Bach, M. L. Bach, P. M. Sondel, et al., Transplant. Rev., 12, 30 (1972).
4. C. Carnaud, J. Charreire, and J.-F. Bach, Cell. Immunol., 28, 274 (1977).
5. H. N. Claman, Cell. Immunol., 13, 484 (1974).
6. H. Folch and B. H. Waksman, J. Immunol., 113, 127 (1974).
7. N. L. Gerber, J. A. Hardin, T. M. Chused, et al., J. Immunol., 113, 1618 (1974).
8. T. Hirano and A. A. Nordin, J. Immunol., 116, 1115 (1976).
9. W. Pierpaoli and E. Sorkin, Specialia, 29, 851 (1972).
10. M. Small, Transplantation, 19, 180 (1975).
11. M. Small and N. Irainin, Cell Immunol., 20, 1 (1975).
12. T. Umiel, in: Immune Reactivity Lymphocytes, New York (1976), pp. 565-569.

IMMUNOBIOLOGICAL STUDY OF HETEROGENEOUS ANTIGENS TO UROPATHOGENIC STRAINS OF *Escherichia coli*

I. I. Podoplelov, A. S. Samoilenko, N. I. Shchipkova, V. I. Burtsev, and D. Ya. Bakanova

UDC 616.61-002.32-092: [579.842.11:612.017.1

KEY WORDS: Escherichia coli; immune response.

Much attention is currently being paid to the study of heterogeneous (cross-reactivity) antigens common to macro- and microorganisms. This is explained by their important role in the development of immunopathological processes and weakening or distortion of the immune response. These properties of bacteria which contain heterogeneous antigens may lead to the formation of a bacterial carrier state, enabling an infectious disease to be converted into a chronic form. Meanwhile the presence of antigens in bacteria identical with those of human erythrocytes may be the reason why an infectious disease affects particular population groups selectively [1-3, 5].

The object of this investigation was to study the role of heterogeneous antigens of the ABO type in strains of Escherica coli in the formation and course of chronic pyelonephritis in man.

Research Laboratory of Experimental Immunobiology, Academy of Medical Sciences of the USSR, Moscow.

[Presented by Academician of the Academy of Medical Sciences of the USSR N. N. Zhukov-Verezhnikov (deceased).] Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 91, No. 6, pp. 708-709, June, 1981. Original article submitted November 17, 1980.

TABLE 1. Study of Antibodies against Autologous E. coli Strains Containing and Not Containing Heterogeneous Type ABO Antigens

Characteristics of strains in relation to presence of type ABO antigens	No. of strains	Mean titer of antibodies discovered in patients (M ± m)	Antibodies not discovered	Antibodies found in titer of over 1:128
Containing antigens	37	19,2±2,5	13	1
Not containing antigens	42	31±3,2 $P<0,05$	11	7

TABLE 2. Characteristics of Different Forms of Chronic Pyelonephritis Depending on Presence of Heterogeneous Antigens in E. coli Strains

Immunogenetic differences between groups	Form of disease, % of cases		P
	latent	recurrent	
Presence of heterogeneous antigens in strains	64	36	<0,02
Absence of heterogeneous antigens in strains of E. coli	20	80	<0,001

Legend. Values of P calculated by comparing forms of disease.

EXPERIMENTAL METHOD

Altogether 140 strains of E. coli isolated from patients with chronic pyelonephritis were studied. All strains possessed morphological and biochemical properties typical of E. coli. To discover heterogeneous antigens of ABO type in E. coli a modified method of absorption of monospecific antibodies [4] was used.

To determine whether genetic determinants of a heterogeneous antigen of the ABO type can be transmitted, E. coli cells isolated from patients were crossed with standard E. coli K-12 strain AB 1157 by Lederberg's method.

Blood groups of patients with chronic E. coli pyelonephritis were determined by the use of monospecific anti-A, anti-B, and anti-O(H) sera. Titers of antibodies against E. coli in the patients' blood were studied by the bacterial agglutination test.

EXPERIMENTAL RESULTS

Of 140 strains tested, type ABO antigens were found in 44.3%, and in most cases (48.4%) an antigen identical with the human O(H)-antigen was found, a combination of OA-like antigens was found in 22.6% of cases, and A- and B-like antigens were detected less frequently. Immunization of rabbits with strains of bacteria containing type ABO antigens yielded sera containing antibodies not only against E. coli antigens, but also against antigens of human erythrocytes of the ABO system, further confirmation that antigens of the ABO type are present in these strains.

During the investigation of the role of heterogeneous E. coli antigens in the pathogenesis of chronic pyelonephritis, besides a study of some clinical laboratory indices, a deliberate comparison was made of the patient's blood group with the presence of an identical cross-reacting antigen in strains of E. coli isolated from this same patient.

Investigation of antibacterial antibodies against autologous strains of E. coli in the serum revealed a regular pattern, as follows: In cases when autologous strains had an identical antigen of ABO type, these antibodies were found in the patients in significantly lower titers. The mean titer of antibodies against strains of bacteria containing identical heterogeneous antigens was 19.2 (Table 1), and against strains not containing

these antigens it was 31. Correspondingly, the highest antibody titers (over 1:128) in seven of eight cases were found against strains not containing heterogeneous antigens.

A study of isoantigens of the ABO system in the patients and of heterogeneous antigens similar to them in the isolated autologous strains showed that they frequently corresponded (in 42 of 50 cases). This high percentage of coincidence of identical group and heterogeneous antigens (84%) cannot be accidental and is evidently associated with antigenic selection of the pathogenic agent for a particular host.

Combinations of different clinical symptoms and their severity formed the basis for distinguishing the two commonest forms of chronic pyelonephritis: recurrent and latent. The clinical features distinguishing chronic pyelonephritis were studied in these groups of patients from the standpoint of analysis of the role of the identical cross-reacting antigens in autologous strains of E. coli isolated from the patients (Table 2). Investigation of 105 patients showed that the recurrent form was present in 58.6% of cases. However, as Table 2 shows, in 50 patients with identical heterogeneous antigens in autologous strains, the latent form, characterized by a protracted and persistent course, often with no obvious symptoms and with only mild clinical manifestations in the form of leukocyturia and bacteriuria for periods of many years, was observed significantly more often (64%). It is an interesting fact that this form was observed with greatest statistical significance ($p < 0.01$) when heterogeneous and group antigens coincided. In the absence of antigens in the microorganisms similar to human ABO antigens, the disease in 80% of patients ran a recurrent course, characterized by periodic exacerbation and a well-marked clinical picture of pyelonephritis.

The possibility of transmission of genetic determinants controlling synthesis of the heterogeneous O(H)-like antigen was investigated by conjugating two strains containing O(H)-like heterogeneous antigen, isolated from the patients, with strain E. coli K-12 AB 1157. Of the 184 recombinants studied, transmission of this heterogeneous antigen was found in 32, i.e., in 17.4% of cases. The marker of the heterogeneous O(H)-antigen in most cases was inherited by recombinants which were selected for the histidine marker. These results are evidence of linking of the histidine determinant and the determinant of the heterogeneous O(H) antigen and that determinants of this antigen can be transmitted during conjugation; this is a matter of great importance for the natural maintenance and spread of heterogeneous antigens in E. coli populations.

The results provide a new approach to the study of the distribution of blood group antigens in patients with chronic pyelonephritis. For instance, in a group of 665 patients the statistically significant predominanting group was formed by those with blood group O(H), which accounted for 40%, whereas in the healthy control group they accounted for 33.5% ($P < 0.001$).

The immunogenetic study of chronic colibacillary pyelonephritis thus yielded data [predominant infection of population groups with blood group O(H) by strains of E. coli containing a O(H)-like heterogeneous antigen, some weakening of immune reactions with the development of a latent form of chronic pyelonephritis in the patients, possibility of transmission of genetic determinants of heterogeneous antigens of ABO type to other strains of E. coli], which on the whole are evidence in support of a role of heterogeneous antigens in the pathogenic agents in the formation of its relations with the human host.

LITERATURE CITED

1. Ch. A. Abdirov, A. D. Dzhumanazarov, and I. I. Podoplelov, Human Blood Groups and Leprosy [in Russian], Nukus (1977).
2. N. N. Zhukov-Verezhnikov, I. I. Podoplelov, N. M. Mazina, et al., Usp. Sovrem. Biol., 74, No. 4, 54 (1972).
3. I. M. Lyampert and T. A. Danilova, Usp. Sovrem. Biol., 75, No. 2, 183 (1973).
4. I. I. Podoplelov, G. M. Bochko, and V. P. Shchipkov, Byull. Éksp. Biol. Med., No. 11, 61 (1971).
5. I. I. Podoplelov and A. S. Samoilenko, in: Abstracts of Proceedings of the 4th Scientific Conference on Clinical Immunodiagnosis [in Russian], Tallin (1978), p. 130.