CORRELATION BETWEEN BLOOD GROUP FACTORS AND SUSCEPTIBILITY TO EXPERIMENTAL INFLUENZAL INFECTION IN MAN

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UDC 616.988.75-092.9-056-02:612.118.221.2

A study of correlation between blood group factors and susceptibility to experimental influenzal infection in man revealed an inverse relationship between the specific antibody level against A2/Hong Kong/1/68 influenza virus and the blood level of isohemagglutinins. In experimental influenzal infection more marked clinical reactions were observed more frequently in persons with blood group A(II) than in those with groups O(I) and B(III). Immunological changes with respect to influenza virus were discovered more regularly in persons with blood group O(I) than with blood group A(II). In susceptible volunteers with a high blood isohemagglutinin level with experimental influenzal infection clinical reactions of moderate and high intensity were observed less frequently than in persons with a low isohemagglutinin level. Normal isohemagglutinins play the role of stimulators of anti-influenzal antibodies and they are one of the factors of immunity against viruses.

The writers' previous investigation [6, 7] showed the participation of the serum isohemagglutinins, determining the blood groups in man, in the increased activity of anti-influenzal antibodies. The regularity and intensity of the potentiating action of the isohemagglutinins increased significantly if the blood groups of the sera containing the antibodies and cofactor corresponded.

The object of the present investigation was to study the relationship between blood group factors, anti-influenzial antibodies, and resistance to influenzal infection in man. For this purpose the level of anti-influenzal antibodies and isohemagglutinins and the intensity of the immunological changes were compared in vaccinated persons with different blood groups; the frequency and severity of experimental influenzal infection in volunteers with different blood groups and with different levels of isohemagglutinins and cofactor in their sera also were compared.

EXPERIMENTAL METHOD

Immune test sera with antibodies against A2/Hong Kong/68 influenza virus for titration of the cofactor activity were obtained from donors with different blood groups and also from persons vaccinated with living influenzal monovaccines prepared from influenza virus of strains A2/Hong Kong/1/68/21 and B/USSR/69/17. Titration of the cofactor in the hemagglutination inhibition test (HIT) was based on the difference between the titers of the immune sera in the native state and after heating for 1 h at 60°C. Sera giving an increase in the antibody titer of 4 times or more after heating were used as the source of the cofactor.

An inhibitor-resistant strain A2/Hong Kong/1/68 of influenza virus and influenza virus B/USSR/69 were used as antigens in the HIT.

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Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 77, No. 6, pp. 80-82, June, 1974. Original article submitted June 26, 1973.

The technique of the HIT in the presence of cofactor, titration of the isohemagglutinins, and their exhaustion were carried out as described by Shashkov et al. [6].

The sera were grouped with standard red cells by Solov'eva's method [4]. The calculations to determine the statistical significance of the results by Fisher's method were carried out on the Minsk-22 computer with a 95% confidence level in the Laboratory of General Epidemiology (Director, Yu. G. Ivannikov) of the writers' Institute.

EXPERIMENTAL RESULTS

The investigation of 194 native sera obtained from persons with different blood groups revealed correlation between the level of specific antibodies against A2/Hong Kong/1/68 influenza virus and the isohemagglutinin level in the blood of donors not vaccinated against influenza. The overwhelming majority of sera of O(I), A(II), and B(III) blood groups had a low level of anti-influenzal antibodies and a high level of isohemagglutinins. The only exception was the sera of group AB(IV), in which α_1-extraisohemagglutinins were detected in only 6.3% of cases.

The isohemagglutinin titer also was studied quantitatively in the sera of persons vaccinated with living A2/Hong Kong/1/68/21 influenzal monovaccine, in whom an increase in the titer of anti-influenzal antibodies against this virus was observed or was absent. Investigation of 169 sera from vaccinated persons showed an inverse relationship between the level of anti-influenzal antibodies and the blood isohemagglutinin level of the volunteers.

It has been shown [9, 12, 13] that the frequency of detection of hemagglutinins against various strains of influenza virus depends on the blood group in man. For instance, after epidemics of A2 influenza in 1957 and 1968 antibodies against homologous virus were found more often in persons with blood group O(I) than in persons with blood group A(II). After the A2/Hong Kong influenza epidemic in 1970 no correlation could be found between the antibody level against the monologous virus in donors' sera and their blood groups.

Correlation between blood group factors and the intensity of the immunologic changes in persons with different blood groups was studied after the immunization of 129 susceptible volunteers with a moderately virulent type-B influenza virus. An increase in homologous anti-influenzal antibodies was observed most regularly in the sera of persons with blood group O(I) (52.6%) and less frequently (31.8%) in sera of group A(II). These results point to correlation between group factors and the immunologic response of the body.

Moderately severe and severe clinical reactions to experimental influenzal infection were given by 24 of the 96 seronegative volunteers. These reactions were observed most regularly (50.0%) in persons with a low (1 : 8 to 1 : 16) isohemagglutinin level and less regularly (16.6%) in persons with a high level (1 : 64 to 1 : 128).

The tests showed that persons with blood group A(II) were less resistant to experimental type-B influenza infection than persons with blood groups O(I) and B(III), in agreement with the observations of Él'kin [7] but not in agreement with the results of McDonald and Zucerman [11] and Tyrrell et al. [14]. An inverse relationship was observed between the isohemagglutinin level and the severity of the clinical reactions in susceptible persons.

These results are evidence that normal isohemagglutinins participate as one factor of natural resistance to influenzal infection in man.

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