EFFECT OF SERUM GLOBULINS FROM PERSONS OF DIFFERENT ABO BLOOD GROUPS ON ALLERGIC REACTIONS OF IMMEDIATE TYPE

S. A. Enikeeva and V. A. Strigin

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The antianaphylactic action of globulins obtained from the sera of persons of different ABO blood groups on active and passive anaphylaxis in guinea pigs and on destruction of mast cells was investigated. Globulins obtained from human serum of the B (III) blood group were shown to have a marked inhibitory effect on allergic reactions of immediate type. Globulin from group O (I) blood does not possess this property.

KEY WORDS: blood groups; globulins; allergy.

The inhibitory effect of γ globulin on passive anaphylaxis has been demonstrated by several workers [6, 7-12]. There is also some evidence [2, 13, 14] that this action depends on the ABO grouping of the blood from which the globulins were obtained.

In this investigation the effect of globulins obtained from sera from people of different blood groups on allergic reactions of immediate type was studied.

EXPERIMENTAL METHOD

Globulins were obtained by salting out with a saturated solution of ammonium sulfate from human serum of groups O (I), A (II), B (III), and AB (IV). Immune sera were obtained from rabbits weighing 2-3 kg and were immunized with bovine serum albumin (BSA) and ovalbumin (OA), precipitated on potassium alum. These antigens were used to produce anaphylactic phenomena: passive general anaphylaxis (PGA) and active systemic anaphylaxis (ASA). PGA was produced in 70 noninbred guinea pigs weighing 200-250 g.

The scheme of the experiments was as follows [14].

Day 1. The guinea pigs were sensitized intraperitoneally with various doses (0.1, 0.2, 0.3, 0.5 ml) of rabbit immune serum (titer 1:5000) against BSA and OA.

Day 2. The animals were placed under a bell jar, into which an aerosol of a 0.01% solution of BSA or OA was introduced for 10 min from a PAI-1 inhaler. The guinea pigs were taken from the bell jar on the first signs of a reaction (untidiness of the hair, scratching the snout, sneezing), and were taken as sensitized. The animals which did not react to the aerosol in a concentration of 0.01% were excluded from the experiment. The guinea pigs that were included were divided into five groups which received injections of 5 ml of globulins of groups O (I), A (II), B (III), and AB (IV) and of physiological saline (control), respectively.

Day 3. The guinea pigs were kept under the bell jar and exposed to an aerosol of a 0.01% solution of OA or BSA antigen. Guinea pigs that did not react to the 0.01% aerosol were exposed to the action of a 0.05% aerosol for 10 min. Guinea pigs reacting weakly to this dose of antigen were taken as partially desensitized. The presence of systemic desensitization was determined by intravenous injection of 1 ml of a solution of BSA or OA containing 0.2-0.25 mg of the antigen. This dose caused a lethal or near-lethal reaction in the control animals. Guinea pigs which did not react to the antigen were taken as systemically desensitized, and those which reacted weakly (+) as partly desensitized. Animals giving severe or lethal reactions (from ++ to anaphylactic shock) were regarded as undesensitized.

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Active systemic anaphylaxis of the guinea pigs was obtained by a single intraperitoneal injection of a sensitizing dose (5 mg/ml) of OA solution. The reacting injection of antigen was given intravenously on the 15th-17th day after sensitization [1]. Anaphylactic shock was divided, depending on the degree of its severity, into mild, moderate, severe, and lethal [5] and was expressed in anaphylactic indices (WCD) [15].

The effect of globulins on anaphylactic shock was assessed from the degree of its severity in animals receiving globulins of the different groups, by comparison with the controls, which received physiological saline instead of globulin.

The severity of the anaphylactic shock was assessed by calculating the anaphylactic index WCD. The ratio between the anaphylactic index in the experimental and control series also was determined. This ratio of WCD_e/WCD_c reflected the alleviation of the anaphylactic shock by the injection of globulins. The less effective the globulins of a particular group, the nearer this ratio came to 1 and, conversely, globulins with stronger antianaphylactic activity gave a WCD_e/WCD_c ratio that was much smaller than 1. Two experiments were carried out on 175 male guinea pigs.

The antianaphylactic activity of the globulin preparations was also determined in the indirect mast cell destruction test [3]. The sources of the antibodies were blood sera from patients sensitive to goosefoot, cocksfoot, wormwood, and sugar beet. The intensity of the mast cell destruction test was expressed as a percentage of the control. The significance of differences between the values compared was determined by means of Student's criterion [4].

EXPERIMENTAL RESULTS

Analysis of the results of the PGA experiments showed that globulins of groups O (I) and AB (IV) had no desensitizing action. Globulins of group A (II) had a partial desensitizing action (23% of the animals used in the experiments were partly desensitized). The globulin obtained from sera of group B (III) was the most effective inhibitor of passive sensitization (80% of the animals were partly desensitized).

In the experiments with ASA globulins of not all groups alleviated the course of anaphylactic shock in the guinea pigs. For instance, the ratio WCD_e/WCD_c was 1 in the group of animals receiving globulin of group O (I). After injection of globulins of groups A (II) and AB (IV) the ratio was 0.9, and after injection of globulins of blood group B (III) it was 0.7. Consequently, a group B (III) globulin was more effective than globulins of groups A (II) and AB (IV). Injection of group O (I) globulin did not protect the animals against anaphylactic shock.

The following fact also was interesting. In the control and after injection of group O (I) globulins 27 of the 35 animals died. Guinea pigs receiving globulins of groups A (II) and AB (IV) reacted after 10-15 min and the number of animals surviving and dying in these two groups was about the same. Guinea pigs receiving group B (III) globulins began to react only 25-30 min after injection of the antigen: In a certain percentage of the animals a weak reaction began and it passed through all stages until anaphylactic shock. Of the 35 guinea pigs used in this experiment 16 were protected against anaphylactic shock by injection of globulin from group B (III) blood.

Tests in vitro showed that group O (I) globulin did not inhibit allergic destruction of mast cells (24% of cells were degranulated, the same as in the control). The same fact was observed previously in experiments in which an indirect basophil degranulation test was carried out with the same globulin (103% of cells degranulated compared with 100% in the control).

Globulins of groups A (II) and AB (IV) had negligible desensitizing action (19 and 21% of degranulated cells, respectively).

Experimental preparations of group B (III) globulin added to the antigen–antibody mixture had a marked antianaphylactic action: Degranulation was observed within the permissible limits of a negative reaction (8%).

The results of these experiments conducted with active and passive anaphylactic phenomena suggest that the mechanism of the greatest anaphylactic effect of globulins may perhaps be determined by genetic differences in the structure and function of these proteins.

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