THE ANTIGENIC STRUCTURE OF THE NORMAL SPLEEN

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Immunological analysis of the antigenic properties of normal human and animal tissues has shown that, like other tissues, the spleen possesses a complex antigenic composition. Besides its organ-specific splenic antigen, the human spleen possesses the group antigens A and B [4] and M and N [5], Rhesus antigen [6] and heterogenic antigens [1].

Certain workers have demonstrated the close resemblance between the antigenic structure of the cells of the spleen and of malignant tumors [2, 7]. No solution has yet been found, however, to the problem of which of the antigens possessed by these two species of cell is responsible for this resemblance.

The object of the present investigation was to make a comparative study of the antigenic structure of the spleen and of a tumor, and to elucidate the problem of the existence of a possible common antigenic component, and of its relationship to the specific antigens of these tissues.

METHOD

The material used in the study consisted of tissues from carcinomatous tumors and of the liver and spleen of a healthy human subject, all belonging to the same blood group, Crocker's sarcoma and the spleen of a mouse. In order to make a comparative analysis of the

TABLE 1. Comparative Study of Antigens from Human Tumor, Liver, and Spleen

Serum	Serum absorbed by	Dilution of serum	Results of complement fixation test with antigens from tissues of		
			human carcinoma	healthy human liver	healthy human spleen
No. 528-II, against human carcinoma	—	1:80	++++	+	++++
		1:160	++++	—	+++
		1:320	++++	—	±
		1:640	++++	—	—
	Spleen tissue	1:80	++++	—	—
		1:160	++++	—	—
		1:320	+++	—	—
		1:640	+	—	—
No. 57, against human spleen	—	1:80	++++	++	++++
		1:160	++	+	++++
		1:320	—	—	++++
		1:640	—	—	++
	Liver tissue	1:80	—	—	++++
		1:160	—	—	++++
		1:320	—	—	+++
		1:640	—	—	±
No. 980, against human liver	—	1:80	±	++++	++
		1:160	—	++++	—
		1:320	—	++++	—
		1:640	—	±	—

TABLE 2. Antigenic Properties of Mouse Spleen

Serum	Serum absorbed by	Dilution of serum	Results of complement fixation test with antigens from tissues of: Crocker's sarcoma	mouse spleen	normal chorioallantoic membrane
No. . . . . , against mouse spleen	—	1:100	++++	++++	++++
		1:200	++++	++++	++++
		1:400	++++	++++	++++
		1:800	++++	++++	++++
	Chorioallantoic membrane tissue	1:100	++++	++++	—
		1:200	+++	++++	—
		1:400	+	+++	—
		1:800	—	++	—
	Tumor tissue	1:100	++	++++	—
		1:200	—	++++	—
		1:400	—	++	—
		1:800	—	+	—
No. . . . . , against mouse spleen	—	1:50	++++	+++	++++
		1:100	++++	++++	++++
		1:200	++++	++++	++++
		1:400	++++	++++	+++
	Chorioallantoic membrane tissue	1:50	++++	++++	—
		1:100	++++	++++	—
		1:200	++++	++++	—
		1:400	++++	++++	—
	Tumor tissue	1:50	+	++++	—
		1:100	—	++++	—
		1:200	—	+++	—
		1:400	—	±	—

antigenic properties, immune sera against the test tissues were obtained in chinchilla rabbits. The rabbits were immunized by means of 3 injections weekly for 4 weeks [3]. The sera were tested with saline extracts of normal and tumor tissues of a mouse or man, used as antigens, in cross complement fixation tests at 37°. All the sera were tested before absorption of their nonspecific, accessory antibodies and after their absorption on formalin-treated tissues. The reaction was assessed as follows: ++++, +++, ++ and + denoted various degrees of inhibition of hemolysis, ± a doubtful reaction, and − a negative reaction.

RESULTS

It may be seen from Table 1, as it has been shown previously [2], that antigens from the tumor and from human liver could be differentiated comparatively easily by means of antitumor and antiliver sera. It also follows from the data in Table 1 that the antigen prepared from healthy human spleen reacted in a considerable titer with the serum of a rabbit immunized with carcinoma tissue. This suggests the presence of related antigens in tumor and splenic tissue, which is confirmed by the positive reaction of the antispleen serum with antigen from tumor tissue. As a result of absorption of the antitumor serum with spleen tissue, however, antibodies remained only to antigen from tumor tissue, and the antibodies held in common with the spleen had disappeared entirely. This is evidence that the common antigenic component of the tumor and spleen is a nonspecific tumor antigen. Absorption of the antispleen serum enabled the absence of a specific tumor antigen from spleen tissue to be clearly established.

The results of the experiment shown in Table 1 thus demonstrate that the common antigenic component of the tumor and spleen is a nonspecific tumor antigen. This immunological relationship between the tumor and spleen cannot be explained by the presence of A and B group antigens, for in our experiments we used material of the same group in respect of these factors. The antigenic resemblance between the tissues investigated likewise could not be attributed to the group factors M, N and Rh, for the latter are detected in tissues by means of special methods.

The presence of a common antigenic component (or components) in human tumor and spleen tissue was thus demonstrated; this component was distinct from the specific tumor and organ-specific spleen antigens and from the group factors A and B, M, N and Rh.

In view of the immunological relationship between the human tumor and spleen, we used mouse spleen as a control during the comparative investigation of the antigenic composition of heterotransplants of a Crocker's sarcoma on the chorioallantoic membrane of the chick embryo, of the original tumor and of tissue from normal organs of the mouse.

The results of the investigation of the spleen antigens by means of an immune serum against normal mouse spleen tissue are shown in Table 2.

We see that the sera of rabbits Nos. 813 and 629, immune to normal mouse spleen, before absorption reacted positively not only with antigen from mouse spleen but also with antigens from Crocker's sarcoma and from normal chorioallantoic membrane, thereby demonstrating the common antigenic structure of these three tissues. As previously established, these three tissues possess a common heterogenic antigen, which is responsible for their resemblance. Absorption of the serum on chorioallantoic membrane tissue led to complete removal of the antibodies to this heterogenic antigen. The sera subsequently continued to react in high titers with antigens from Crocker's sarcoma and mouse spleen, which was evidence of the presence of a common antigenic component in these tissues, distinct from the heterogenic antigen. Absorption of the serum on tumor tissue led to removal of the antibodies not only to the heterogenic antigen possessed in common with the chorioallantois, but also to the antigenic component common to the spleen and Crocker's sarcoma. After absorption on tumor tissue, the serum became specific and reacted only with organ-specific mouse spleen antigen.

The results of the experiments shown in Table 2 thus provide evidence in support of the complex antigenic structure of the spleen of the mouse. It may be seen that mouse spleen possesses, besides its organ-specific spleen antigen, a heterogenic antigen common to the chorioallantoic membrane of the developing chick embryo and a third antigenic component common to Crocker's sarcoma.

The complex antigenic structure of the spleen of man and animals must be borne in mind when spleen tissue is used for control purposes in immunological experiments.

SUMMARY

The antigenic structure of human and mouse spleen was studied. Along with the organ-specific splenic antigen, an antigenic component in the splenic tissue of man was revealed, common with the human spleen and cancer tissue, but differing from the specific tumor antigen. The presence of an antigenic component, common with Crocker's sarcoma, was revealed in the mouse spleen. Moreover, a specific splenic and heterogenic antigen, common with the chorioallantoic membrane of the chick embryo, is present in the mouse spleen.

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