

A STUDY OF THE ANTIGENIC PROPERTIES OF KIDNEY AND HEART TISSUES OF HUMAN EMBRYO IN EMBRYOGENESIS

UDC 612.63.017.1.085.2

A. I. Iskhakov

Tashkent Scientific Research Institute of Vaccines and Sera (Director – Candidate of Medical Sciences, A. A. Abidov) and the Laboratory of Immunologic Embryogenesis (Professor O. E. Vyazov, in charge) of the Moscow Institute of Experimental Biology AMN SSSR (Director – Professor I. N. Maiskii)

(Presented by N. N. Zhukov-Verezhnikov Active Member of AMN SSSR)

Translated from *Byulleten' Éksperimental'noi Biologii i Meditsiny*, Vol. 57, No. 4, pp. 108-111, April, 1964

Original article submitted April 28, 1963

Immunoembryology, as a branch of noninfectious immunology attracted, during recent years, intensive attention of researchers and clinicians.

For solution of the problem of antigenic compatability of mother and fetus, to which are related the questions of organogenesis and normal establishing of functions of the developing embryo [2, 5], it is necessary, in general, to study the developmental process of antigenic tissues and organs of the embryo. Until the present time, development of the tissue antigens in the course of embryogenesis has been studied primarily in amphibia and birds [3].

The development of species specific antigens during human embryogenesis has not been studied as such. We have been able to find only two references to studies related to this question.

R. F. Averkina [1] carried out a comparative study of interspecies antigenic properties of the heart tissues of human embryos and fetuses of different ages; in the course of the study these tissues have been compared with monkey heart tissue. It has been established that the antigenic similarity of human heart tissue to the monkey heart tissue is most prominent during the early stages of development (6-7 weeks). With the development of human embryos the similarity decreased.

Tsoneva-Maneva [7] carried out a comparative study of serum antigens of human embryos at different stages of development and those of animals, by precipitation reaction in agar gels with immune serum, obtained as a result of immunization of a rabbit with adult human serum. The number of antigens increased with aging of human embryo from 3-6 antigens in the serum of two-month old human embryo to 8-11 antigens in the serum of the eight-month old fetus. It is assumed that it is related to the absence in the human embryo serum of a series of antigens present in adults, inasmuch as the adult serum gives precipitation lines absent in the reaction with the embryo serum. As a result of the reaction with antibodies obtained by immunization of rabbits with antigens of a horse, hen, turtle, frogs and fish, it has been established that the antigens in the human embryo serum are similar to or identical with the serum antigens of the above enumerated animals. The two-months old human embryos without these serum antigens represent an exception. The author considers that the obtained data confirm the biogenetic rule.

Having decided to carry out additional studies dealing with the question of antigenic species specificity of human embryo tissues, we designed experiments for studying antigenic properties of human embryo tissues of different stages of development: before placentation (6-9 weeks), after completion of placentation (15-19 weeks) and at 35-40th week of pregnancy, as well as tissues of an adult human being. The anaphylactic reaction in guinea pigs with desensitization has been used in the experiments [4].

EXPERIMENTAL METHOD

Guinea pigs weighing 300-350 g were inoculated subcutaneously with 32 mg suspension of kidney and heart tissues of human embryos at different stages of development and of adult human beings.

TABLE 1. Anaphylactic Reaction in Guinea Pigs Sensitized with Human Embryonic Kidney Tissues in Response to an Injection of Adult Human Serum

Guinea pig No.	Sensitization		Shocking injection (intraperitoneal)		
	antigenic tissue suspension	dose (in mg)	antigen	dose (in mg)	reaction
1	Kidney of 6-9 week old embryos	32	Human serum	1	+
2	Kidney of 6-9 week old embryos	32	Ditto	1	+
3	Ditto	32	"	1	+
71	"	32	"	1	+
72	"	32	"	1	+
79	"	32	"	1	+
33	Kidney of 15-19 week old embryos	32	"	1	++
34	Ditto	32	"	1	++
35	"	32	"	1	++
61	"	32	"	1	++
62	"	32	"	1	++
63	"	32	"	1	++
11	Kidney of 35-40 week old embryos	32	"	1	++
14	Ditto	32	"	1	++
16	"	32	"	1	++
126	"	32	"	1	++
127	"	32	"	1	++
129	"	32	"	1	++
77	Kidney of adult person	32	"	1	+
78	Ditto	32	"	1	+
80	"	32	"	1	+
94	"	32	"	1	+
97	"	32	"	1	+
99	"	32	"	1	+
105	Not sensitized guinea pigs	.	"	1	-
106	Ditto	.	"	1	-
108	"	.	"	1	-

Legend for this table and for Table 2: + tremor, scratching of nose and ears, bristling of hair, rapid respiration, slight lowering of temperature; ++ the same symptoms, expressed more acutely; guinea pig sneezes frequently; +++ the same symptoms, expressed even more acutely; convulsive leaps, coughing, side position, but the animal survives; - symptoms of anaphylactic shock are absent; injection not carried out.

Every organ was freed of the capsule, fat, evident connective tissue and was carefully washed free of blood, at first with distilled water and subsequently with physiological saline until the wash fluid was completely transparent. The tissues were reduced to small pieces, dried with filter paper and weighed. Then the tissues were placed in a sterile mortar and were carefully ground. In the course of grinding, physiological saline was gradually added to the mortar at the rate of 1 ml of the saline per 100 mg of tissue. The obtained suspension of tissues was used for subcutaneous sensitizing injections.

On the 21st day after sensitizing injection the guinea pigs were inoculated intraperitoneally with the shocking dose of the antigen - up to 1 ml of human serum (diluted 1:5). The degree of reaction was evaluated using 4 + system [6].

TABLE 2. Anaphylactic Reaction in Guinea Pigs, Sensitized with Suspensions, in Response to an Injection of Adult Human Serum

Guinea Pigs No.	Sensitization (subcutaneous)		Shocking injection (intraperitoneal)		
	antigenic tissue suspension	dose (in mg)	antigen	dose (in mg)	reaction
4	Heart of 6-9 week old embryos	32	Human serum	1	++
5	Ditto	32	Ditto	1	++
6	"	32	"	1	++
70	"	32	"	1	++
74	"	32	"	1	++
76	"	32	"	1	++
30	Heart of 15-19 week old embryos	32	"	1	++
31	Ditto	32	"	1	++
32	"	32	"	1	+++
59	"	32	"	1	+++
66	"	32	"	1	++
18	"	32	"	1	+++
7	Heart of 35-40 week old embryos	32	"	1	+++
8	Ditto	32	"	1	++
9	"	32	"	1	+++
120	"	32	"	1	+++
123	"	32	"	1	+++
125	"	32	"	1	+++
37	Heart of adult person	32	"	1	++
92	Ditto	32	"	1	+++
85	"	32	"	1	+++
91	"	32	"	1	+++
100	"	32	"	1	+++
89	"	32	"	1	++
110	Not-sensitized guinea pigs		"	1	-
101	Ditto		"	1	-
102	"		"	1	-

EXPERIMENTAL RESULTS

The results of experiments dealing with antigenic species specificity of human embryonic kidney tissues as indicated in Table 1, the results of analogous experiments with embryonic heart tissues are shown in Table 2.

Positive anaphylactic reaction was observed in all guinea pigs sensitized with suspensions of human embryonic tissues (6-9, 15-19, 35-40 weeks of development) as well as with adult human tissues, in response to the shocking of human serum — an antigen having well established species specific properties. No anaphylactic symptoms were observed in all non-sensitized guinea pigs (experimental control).

It can be seen also from Table 1 that a reaction designated as ++ was noted in guinea pigs sensitized with kidney suspension of human embryos 15-19 and 35-40 weeks of development. However, guinea pigs sensitized with kidney suspension of embryos 6-9 weeks old and of adult person showed anaphylactic reaction evaluated in general as +.

On the basis of these data, one can assume that species specificity of kidney tissues increases somewhat towards 15-19 weeks of development, and again decreases when adult tissues are used.

As it can be seen from Table 2, guinea pigs sensitized with a heart suspension of 6-9 week old embryos, responded with a reaction evaluated in general as ++. At the same time, in guinea pigs sensitized with heart tissue suspensions of 15-19 and 35-40 week old embryos and of adult human, responded with an anaphylactic reaction evaluated generally as +++.

These data allow the assumption that unlike the kidney tissues, the heart tissues are characterized in the course of development with increasing antigenic species specificity.

As a result of our experiments, it has been established that the tissues during all studied periods of development are species specific. With heart tissues, antigenic species specificity is most pronounced in 15-19 and 35-40 week old embryos. With the development of human embryos antigenic species specificity of heart tissues, apparently, increases somewhat; as for the kidney tissues, their antigenic species specificity apparently increases somewhat toward the 15-19 week of development, and begins to decrease again after 40 weeks.

SUMMARY

A study was made of the antigenic species specificity of human embryonic kidney and heart tissues as various developmental periods. The method of anaphylaxis with desensitization on guinea pigs was used.

The development of human embryos is paralleled by the rise of the antigenic species specificity of heart and kidney tissues. The nature of species specificity changes occurring in the heart tissues during embryogenesis somewhat differs from that particular to alterations operating in the kidney tissue.

LITERATURE CITED

1. P. F. Averkina, Comparative Study of Antigenic Properties of Animal and Human Tissues. Thesis of the Candidate, Moscow (1959).
2. L. S. Volkova, The Problem of Immunobiologic Relationship of Mother and Fetus. Thesis of the Candidate, Moscow (1955).
3. O. E. Vyazov, Immunologie Embryogenesis, Moscow (1962).
4. L. A. Zil'ber, Advances in Modern Biology, Vol. 3, No. 2 (1950), p. 188.
5. A. I. Iskhakov, Med. zh. Uzbekistana, No. 3 (1963), p. 32.
6. B. V. Konyukhov, Byull. éksper. biol., No. 4 (1956), p. 66.
7. M. Tsoneva-Maneva, Ibid., No. 5 (1962), p. 90.

All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.