forks and dimensions of replication units) in these cells capable of successful passage were the same as those in embryonic and postnatal human fibroblasts.

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EFFECT OF HEAT STRESS ON MORPHOGENETIC POTENTIAL OF NEPHRON EPITHELIUM

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UDC 612.465.014.2-06:612.591

KEY WORDS: kidney; tissue culture; heat stress.

The study of the effect of heat stress on the morphogenetic potential of the nephron epithelium is important for predicting the effects of exposure of the organism and its systems to extremal temperatures. Information in the literature on the effect of heat stress on the excretory system deals with structural and functional shifts [2, 4, 6, 9, 10].

The object of this investigation was to study the action of heat trauma on proliferation, growth, and differentiation of the epithelium of the rat nephron in culture *in vivo*.

EXPERIMENTAL METHOD

Heat stress was produced by keeping animals in a ventilated hot chamber at 45°C for 60 min. The method of organ and tissue culture described by Lazarenko [3] was used. This method gives good results in the study of reactive and plastic properties of the epithelium and tissues of the internal medium and the principles of histogenesis, and for simulating organogenesis and differentiation [3, 11]. This method is being used for the first time to analyze the effect of extremal temperatures on the biological potential of tissues.

Experiments were carried out on 46 male albino rats, in two series: The donors were healthy animals (series I) and animals exposed to heat stress (series II), aged 6 months; the recipients in both series were rats aged 2 months. Under sterile conditions the donors' kidney was removed, decapsulated, and rinsed in physiological saline; the cortex was cut into small pieces measuring 0.67 mm^2, mixed with an equal quantity of neutral celloidin, and implanted subcutaneously into the recipients' anterior abdominal wall. The implants were removed after 1, 3, 6, 8, 10, 15, and 30 days, fixed in Carnoy's fluid, and sections were cut and stained.

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(Presented by Academician of the Academy of Medical Sciences of the USSR I. V. Toroptsev.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 92, No. 9, pp. 352-355, September, 1981. Original article submitted January 27, 1981.

0007-4888/81/9209-1263$07.50

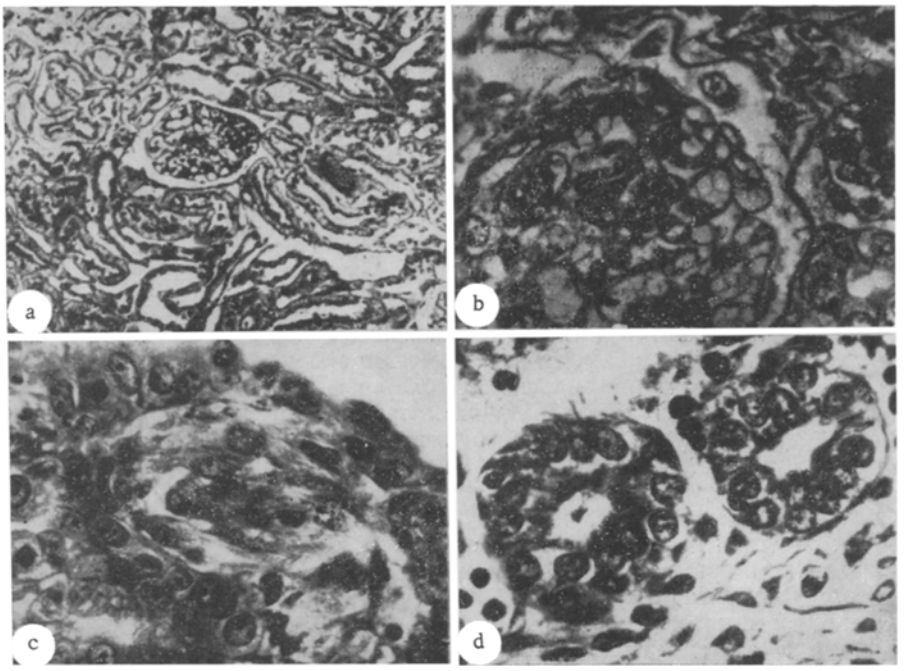

Fig. 1. Growth and transformations of nephron epithelium of rat in culture *in vivo* after heat stress. A) Kidney of rat aged 6 months after stay in hot chamber at 45°C for 60 min. Superficial zone. Mayer's hematoxylin and eosin, 140 ×; B) implant of kidney of healthy rat on 3rd day of experiment. Progressive destructive changes in tissues in culture. Hematoxylin-eosin, 630 ×; C) implant of kidney from rat aged 6 months after heat stress on 3rd day of experiment. Pavement growth of epithelium. Mayer's hematoxylin and eosin, 630 ×; D) implant of kidney from rat aged 6 months after heat trauma on 6th day of experiment. Organotypical reorganization of epithelium. Mayer's hematoxylin and eosin, 630 ×.

EXPERIMENTAL RESULTS

Keeping the animals in the hot chamber at 45°C for 60 min led to a disturbance of the renal hemodynamics, with an increase in vascular permeability, ischemia of the superficial and congestion of the juxtamedullary zones of the cortex, and dystrophic changes in the proximal and focal dilatation in the distal parts of the nephron (Fig. 1A).

A tissue-vascular reaction developed in the focus of implantation of kidney tissue from the healthy and experimental animals, leading to the formation of a connective-tissue capsule, bands of tissue between the layers of celloidin, and intramural blood vessels of the implant itself. The principal stages of histogenesis of the connective tissue and formation of the vascular basin correlated strictly with morphogenetic transformations of the epithelium of the cultured fragments. The implanted tissues passed successively through stages of depression and adaptation, proliferation and growth, differentiation and organogenesis, and regression. In both series each stage had its own qualitative and temporal features.

In the control experiments depression and destruction of the cultured tissues continued until the 3rd day and affected most of the renal corpuscles and proximal parts of the nephron. Activation of the epithelium of the distal part, the loop of the nephron, and individual proximal epitheliocytes, observed in the narrow peripheral zone of the implant, determined the proliferative stage of implantation growth (Fig. 1B). These processes took place only within the cultured fragments, in the form of growth of the epithelium over the old basement membrane, formed by undifferentiated epithelial bands. As the inflammation subsided, on the 6th-8th day the foci of epithelial proliferation underwent differentiation, with the development of tubular structures lined with simple squamous, cubical, and low-prismatic epithelium. No newly formed renal corpuscles could be identified. In the period

from the 10th day and later, lymphoid infiltration of the implant began, and by the 15th day the epithelial structures were resorbed.

In the experimental series, in the early stages edema, lymphocytic infiltration, and mass destruction of the renal corpuscles and tubules were more marked in the implants. The rapid abolition of depression had the result that by the 3rd day active proliferation within the cultured fragments and also around the periphery of the implant had resulted in the formation of epithelial covering layers (Fig. 1C), undifferentiated bands of deep growth, and spongiose structures. Growth of the epithelial lining of the nephron in culture *in vivo* is known to take place only during culture of the kidney from donors during pre- or neonatal ontogeny. This fact, together with the widespread distribution and polymorphism of the regenerating epithelium suggest that heat stress activates the proliferative activity of the epithelium of the nephron. Pathological mitoses (multipolar, monocentric, asymmetrical) found in foci of regenerating epithelium indicates a disturbance of the mitotic process. Similar changes also have been found in tissue cultures exposed to a low environmental temperature, ionizing radiation, and virus infection and in organs undergoing hyperplasia [1, 8]. In the present experiments the proliferative phase lasted until the 10th day. The formation of connective-tissue bands in the implant was delayed. Processes of organogenesis took place initially within the cultured fragments, later in the newly formed connective tissue of the implant. Epithelial constructions corresponding to the early stages of nephronogenesis were formed. Epithelial tubes (Fig. 1D) were characterized by a polymorphic lining, ranging from simple squamous to cubical or low-prismatic, with evidence of secretory activity. Cysts, sometimes branched, also were formed. On the 6th day lymphoid infiltration of the connective-tissue bed of the implant began and the epithelial constructions underwent regression before they could reach the stage of functional differentiation.

Acute heat stress had on the whole an initiating influence on the course of morphogenesis of the nephron epithelium under the conditions of culture. The rapid abolition of depression and adaptation of the cultured fragments to the new conditions of existence in the prevascular period of nutrition in the implants were the result of massive desquamation of the highly differentiated cells of the nephron epithelium during heat stress, which in turn was connected with disturbances of the hemodynamics and dystrophic changes in the tubular structures. This preliminary stage led to increased proliferative activity of the nephron epithelium and mobilization of its oldest eliminative properties. The sources of reparative regeneration were the distal and certain proximal epitheliocytes, cells of the nephron loop, and of the capsule of the renal corpuscle. Proliferating epithelial tissue spread not only within the seeded fragments, but also along the newly formed connective tissue, in the form of undifferentiated covering layers, bands of deep growth, spongiose structures, and growth along the old basement membrane. Differentiation of the regenerating epithelial tissue led to the formation of atypical renal corpuscles in the early stages of nephronogenesis and to the formation of epithelial tubules. Pathological mitoses observed in the epithelium during the period of proliferation reflect disturbances of the mitotic cycle and confirm the nonspecific character of exposure to extremal temperatures.

The facts described above suggest that organ and tissue culture is a very promising method of evaluating the results of exposure to extremal factors in connection with the development of objective criteria for their influence on the biological properties of organ and tissue systems.

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REDISTRIBUTION OF T AND B LYMPHOCYTE POPULATIONS AMONG LYMPHOID ORGANS DUE TO HYDROCORTISONE

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UDC 612.112.94.014.46:615.357.453

KEY WORDS: hydrocortisone; lymphoid organs; T and B lymphocytes.

The mechanism of action of corticosteroid hormones on lymphoid tissue has been studied by no means completely. However, it is already clear that corticosteroids have a varied influence, depending on many factors: the type of corticosteroid, the dose and duration of its administration, and the species of the test animal. Reports have recently been published indicating that glucocorticoids affect predominantly migration and recirculation of lymphocytes *in vivo*. The most marked changes are those in recirculation of the T lymphocyte pool [1, 3, 5, 6]. However, the possibility of an effect of corticosteroid hormones on redistribution of the B cells also cannot be ruled out, although the data on this question are contradictory [7-10].

The object of this investigation was to study the redistribution reactions of T and B lymphocytes after injection of hydrocortisone into guinea pigs which, like man, are a cortisol-resistant species.

EXPERIMENTAL METHOD

Experiments were carried out on 105 guinea pigs weighing 300-400 g. Hydrocortisone acetate (from Gedeon Richter, Hungary) was used in the investigations. Hydrocortisone was given as a single intramuscular injection in doses of 30 and 100 mg/kg body weight. The relative and absolute numbers of T and B lymphocytes in the thymus, bone marrow, paratracheal lymph nodes, spleen, and peripheral blood were determined 4, 12, and 24 h after injection of the hormone. T lymphocytes were identified by their ability to form spontaneous rosettes with rabbits' erythrocytes [9]. B lymphocytes were identified by their possession of receptors for the 3rd component of complement [4].

Rosette-forming cells were counted after staining with acridine orange in a mixture of ordinary and UV light. Structural changes in the lymphoid organs were analyzed in histological preparations stained with hematoxylin and eosin and by Van Gieson's method.

EXPERIMENTAL RESULTS

The results indicated early changes in the ratio between T and B lymphocyte populations after administration of hydrocortisone (Fig. 1).

Department of General Pathology and Central Research Laboratory, Kazan' Postgraduate Medical Institute. (Presented by Academician of the Academy of Medical Sciences of the USSR A. D. Ado.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 92, No. 9, pp. 355-356, September, 1981. Original article submitted November 11, 1980.

 0007-4888/81/9209-1266$07.50