MORPHOLOGY AND PATHOMORPHOLOGY

Correlation of Prolactin Concentration with Levels of Other Hormones and with Ultrastructural Morphometric Parameters of the Testes in the Human Fetus

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Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny,* Vol. 119, № 6, pp. 654-656, June, 1995
Original article submitted August 19, 1994

Consideration is given to the correlations between variations of the prolactin concentration and other hormonal parameters in the human embryonic period. The interrelation between the prolactin concentration and ultrastructural parameters of the testes is also traced.

Key Words: *testis; embryogeny; prolactin*

Much has been written about the hormonal regulation of gonad function, mainly the action of such regulators as follicle-stimulating hormone (FSH) or luteinizing hormone (LH). However, the role of other hormones in this system (both in the mature and in the developing organism) has rarely come under study. One of the main hormones, prolactin, is currently attracting growing interest [2], and here we attempt to study the formation of interrelations between the gonads and various hormonal regulators in the human embryonic period.

MATERIALS AND METHODS

Material was obtained from 10 normal human fetuses sampled in the 20th-21st week of intrauterine development. The hormonal analysis of the blood was performed using the Amerlight method with an LKB 1230 Arcus fluorometer (Delfia).

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Pieces of testis for electron microscopy were fixed in glutaraldehyde, postfixed in osmium tetroxide, and after dehydration embedded in Epon-Araldite. Ultrathin sections were prepared on an LKB III ultratome. The material was analyzed with an electron microscope.

Morphometric analysis was performed under medium magnifications (1500-2000) using a morphometric grid to determine the areas of nuclei in different cell components of the developing testis (gonocytes, presumptive sustentocytes, glandulocytes, and myoid cells) and using the "point count" method to obtain the relative volumes of nuclei and cytoplasm. High magnifications (8000-10,000) were used to detect the relative number of the main cytoplasmic organelles in different testicular cells [1]. Mathematical processing of the data was performed with Statgraph software.

RESULTS

Data on hormone concentrations, ultrastructural parameters, and on the correlation of the findings with individual variations of prolactin concen-

0007-4888/95/0006-0631$12.50

TABLE 1. Correlation of Hormone Concentrations and of Some Morphometric Parameters with the Prolactin Level in Human Embryonic Blood in the 20th–21st Week of Intrauterine Development

Parameter	($M \pm m$)	Correlation with prolactin level	
		correlation coefficient	reliability of correlation
Concentration of:			
prolactin, mmol/liter	118.7±37.06		
FSH, U/liter	13.5±5.57	−0.33	0.35
LH, U/liter	100.79±42.53	0.23	0.52
testosterone nmol/liter	10.62±5.4	−0.14	0.7
estradiol, pmol/liter	10.46±2.1	−0.55	0.099
thyrotropin, pmol/liter	3.51±0.7	−0.04	0.9
cortisol, nmol/liter	156.7±28.5	0.71	0.02
thyroxine, nmol/liter	65.7±19.09	0.08	0.74
Size of sustentocyte nuclei, μ^2	43.1±3.4	0.9	0.04
Nuclear–cytoplasmic ratio of gonocytes	0.78±0.09	−0.9	0.002
Relative volume of glandulocytes in interstitium, %	16.36±1.05	0.9	0.02
Relative volume of myoid cell cytoplasm in interstitium, %	3.45±0.47	0.9	0.0001

tration in a series of observations are listed in Table 1.

Mathematical analysis revealed a correlation between individual variations of prolactin concentration in the fetal blood and variations of some other hormone concentrations. For example, the significant negative correlation exists between the prolactin and estradiol concentrations, while prolactin and cortisol correlate positively.

Regression analysis revealed correlations between concentrations which can be summarized in the following equation:

[luteotropic hormone]=208.24-12.58[estradiol]-24.93 [thyrotropic hormone]+0.83[cortisol] (determination coefficient -86.95%, p=0.0046; degrees of influence of the concentration: 30.3, 16.98, and 39.67% for estradiol, thyrotropic hormone, and cortisol, respectively). The prolactin concentration is directly proportional to the cortisol concentration and inversely proportional to the estradiol and thyrotropin concentrations.

It should be noted that no direct relationship was found between individual variations of prolactin, on the one hand, and FSH, LH, and testosterone, on the other. However, there are published data on the possibility of prolactin regulation of testosterone secretion in rats on the 16th day of intrauterine development [3]. If such interrelations are characteristic for human ontogenesis as well, they may be explained by the following correlations: [estradiol]=44.56-1.35[age]+0.127 [FSH]-0.035[luteotropic hormone]-1.96[thyrotropic hormone]+0.042 [thyroxine] (determination coefficient -92.67%, p=0.0218; degrees of influence of the concentration: 26.53% for FSH, 30.82% for luteotropic hormone, 8.36% for thyrotropic hormone, 4.1% for thyroxine, and 22.86% for age within the considered range);

[FSH]=-7.68+0.53[testosterone]+1.45[estradiol] (determination coefficient -59.1%, p=0.0438; degrees of influence of the concentration: 30.6% for estradiol and 28.5% for testosterone).

Thus, it is evident that the relationship between prolactin and testosterone may be realized via the action of FSH and estradiol. The correlation between the concentrations of prolactin and thyrotropic hormone may be attributed to common hypothalamic regulatory factors for both hormones. On the other hand, the correlation pair "prolactin-cortisol" is less clear.

Comparison of the findings with individual variations of testicular ultrastructure brings to the fore the following correlation pairs: "prolactin - relative number of presumptive glandulocytes in the interstitium" with a strong positive correlation; "prolactin - relative volume of myoid cell cytoplasm" with a strong positive correlation; "prolactin - absolute areas of sustentocyte nuclei" with a strong positive correlation; "prolactin - nuclear-cytoplasmic coefficient of gonocytes" with a strong negative correlation.

These data attest to the close interrelations between prolactin and practically all major structures of the developing testis. The question as to whether prolactin acts upon the testis directly or indirectly is still obscure. The prevailing view is that prolactin modulates the function of luteinizing hormone [2].

According to our findings, the correlation of prolactin concentration with parameters of testicu-

lar ultrastructure is stronger than that with concentrations of hypophyseal gonadotropins. This suggests that prolactin is a very important regulator in the developing testis.

This study received the financial support of the Russian Foundation for Basic Research.

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Morphofunctional Aspects of Liver Regeneration in Experimental Correction of Toxic Hepatitis

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Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 119, № 6, pp. 656-659, June, 1995
Original article submitted July 4, 1994

It is demonstrated that cytoplasmic extract of rat pup liver stimulates cellular and intracellular regeneration of hepatocytes exposed to the toxic agent CCl_4. Injection of liver cytosol stabilizes lysosomal membranes, increases the coefficient of energy efficiency of mitochondria, and activates proliferation of polyploid hepatocytes.

Key Words: *toxic hepatitis; hepatocytes; regeneration; polyploidization; liver cytosol*

In the search for new drugs effective against liver diseases considerable attention has been paid to natural metabolites which can be used for the prevention and correction of toxic damage to the liver [2,4,5]. A detailed analysis of cellular and intracellular mechanisms of liver regeneration exposed to toxic agents [9-11] makes it possible to define key events in the transformation of the organ and to select such methods of correction that maximally approximate the processes to physiological regeneration. For example, it has been demonstrated that under the action of CCl_4 the mass of hepatocytes and, consequently, of the liver increases predominantly due to polyploidization of cells at a low proliferative activity [8,13] and reduced percentage of binuclear hepatocytes [1]. It has been assumed that these changes in the hepatocyte population promote premature aging of the organ [3], since the number of cells never reaches the initial value.

We studied regeneration of the liver after acute damage caused by CCl_4 against the background of cytoplasmic extract prepared from rat pup livers (liver cytosol, LC) by monitoring intracellular and cellular mechanisms of hepatocyte regeneration.

MATERIALS AND METHODS

Experiments were performed on 50 male Wistar rats weighing 150-200 g. The animals were divided into four groups. Group I rats were given CCl_4 in olive oil (0.1 ml/100 g body weight) via a gastral tube three times at 48-h intervals. Group II animals were administered the same dose of CCl_4 against the background of a 7-day administration of LC. Groups III and IV animals served as controls; they were administered the extract solvent (0.6% NaCl, 0.5 ml) and LC, respectively, during a 7-day period. Material for investigation was collected 24 h after the last administration of solvent or extract.

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0007-4888/95/0006-0633$12.50