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EFFECTS OF PİNEALECTOMY ON THE PLASMA LEVELS OF THYROİD HORMONES IN THE RAT

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Summary: The link between the pineal gland and the reproductive system is well established. However, an influence of the pineal gland on other endocrine glands has also been studied. The pineal gland has recently been shown to have an important influence on the mechanism controlling vasopressin release and the daily rhythms of this hormone. The pineal gland may be thought to be involved in the function of the hypothalamus-pituitary- thyroid axis. In order to investigate the possible relationship between the pineal gland and thyroid function, we have studied the effects of pinealectomy on the blood levels of thyroid hormones, triiodothyroine (T_3) and thyroxine (T_4). The evening plasma concentration of T_3 was significantly lower ($P<0.05$) in the pinealectomized group than in the control group. This result indicates that the pineal may have an effect on thyroid function.

Key words: Pineal gland, pinealectomy, thyroid hormones

The relationship between the pineal gland and the growth of the gonads is most studied. The effects of the pineal gland and pineal components on other endocrine glands have also been studied. It has recently been shown that the pineal gland has a significant role in the generation of the daily changes in neurohypophysial activity (2). The pineal gland may be thought to be involved in the function of the hypothalamus-pituitary-thyroid axis in a similiar manner. There are some studies on the relationship between the pineal gland and thyroid function. An inhibitory role is suggested for the pineal gland in thyroid physiology (9).

Pinealectomy increases the rate of T_4 secretion. Melatonin decreases the rate of T_4 secretion and depresses plasma T_4. Thyroid hypertrophy occurs as a consequence of pinealectomy. Moreover, melatonin increases thyroid stimulating hormone (TSH), so one action of the pineal may be on the pituitary (1). There is some evidence suggesting that pineal gland has a modulatory influence on the neuroendocrine thyroid axis of hamsters. In hamsters kept under a 14L/10D

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photoperiod, daily melatonin injections resulted in inhibition of circulating T_4 levels (6). It should be mentioned that the action of melatonin depends not only on dose, but also on time of administration with respect to the daily photoperiod and the duration that melatonin is avaliable in the plasma during each day(10). It has been reported that daily afternoon injections of the immediate precursor of melatonin, N-acetylseratonin, as well as one of its major liver metabolites, 6-hydroximelatonin, had no effects on plasma T_4 concentrations (7). Exposure of Syrian hamsters of either sex to a short daily photoperiod or blinding by bilateral orbital enuclation results in suppression of serum T_4 and T_3. These effects are prevented by pinealectomy or subcutaneous implants of the pineal hormone, melatonin (8). The height of thyroid follicular epithelial cells can be used as a guide in the assesment of TSH activity (5). In the rat, Losada (3) reported that thyroid follicular cell height was significantly increased in pinealectomized animals. Rintamakei at al (4). observed that there is no clear function relationship between the pineal gland and thyroid function. In order to investigate the possible relationship between the pineal gland and thyroid function, we have studied the effect of pinealectomy on the blood levels of thyroid hormones, T_3 and T_4.

MATERİAL AND METHOD

Animal preparations

The studies were performed on 45 male Swiss-albino rats weighing 250-330g. They were maintained on a 12h light/12 h darkness cycle (lights on at 08.00h) and housed under conditions of constant temparature and humidity. Food and water were given ad libitum. The animals were divided into two groups. The first was surgically pinealectomized with intraperitoneal sodium pentobarbital (35mg/kg body weight). The second group was left intact as control. 12 weeks after the operation, animals from each of the groups were decapitated between 07.00-08.00 h. and 19.00-20.00 h. Trunk blood was collected into chilled heparinized tubes, and the plasma samples were stored at -20C^{o} until analysis.

Analyses

Plasma T_3 (Triiodothyronine) and T_4 (thyroxine) were determined by radioimmunoassay, using T_3 and T_4 kits. (Amersham, Buckinghamshire, England). Co-efficients of variation of T_3 and T_4 are 3.7% and 3.2% , respectively.

Statistical analysis

Values are given as means ± S.E.M. Differences between the mean values of the sets of observations were compared using Student's t-test and were considered to be significant at $P<0.05$.

RESULTS

There was no significant change between the mean values of the body weights of the groups. The evening circulating concentration of T_3 was significantly lower in the pinealectomized group ($P<0.05$), being 30.85±2.33 ng/dl (n=15) as compared with 35.53±2.19 ng/dl (n=10) in the control group. There was no significant differences (Student's t-test $P>0.05$) in the morning and evening values of plasma T_4 between the groups. The morning and evening values of the group showed no significant daily changes except the T_3 values in the

pinealectomized group. There was a significant change between the morning and evening values of T_3 in pinealectomized group (Table I).

a daily rhythm in the pinealectomized group, being higher in the morning. In spite of not being statistically significant, the evening values of plasma T_3 was higher than the morning values in the control group, and the

Table I. Effect of Pinealectomy on the Plasma Levels of Thyroid Hormones

	Control		Pinealectomized	
	Morning	Evening	Morning	Evening
Body weight (g)	297.00 ±10.00	268.00 ±11.33	268.66 ±15.26	265.00 ± 7.92
Plasma T_3 (ng/dl)	33.17 ±1.19	35.53 ± 2.19	36.69 ±1.53	30.85 ± 2.33*
Plasma T_4 (ng/dl)	2.93 ± 0.27	2.82 ± 0.16	2.82 ±0.26	3.07 ± 0.19

*P<0.05 compared with control evening and pinealectomized morning values.

DİSCUSSİON

This study does not confirm the earlier observations that pinealectomy increases the rate of T_4 secretion (1), and the pineal gland has an inhibitory influence on thyroid physiology (9). In our study, only plasma evening values of T_3 showed significant difference between control and pinealectomized group.

In the light of this result, it can be suggested that the pineal gland may exert an effect on the conversion of T_4 to T_3 or T_3 release rather than T_4 release. Since the biologically active thyroid hormone is T3, this findig seems to be important with respect to thyroid function. There is no previous evidence indicating that plasma T_3 and T_4 concentrations in the rat show a daily rhythm. In this study, only plasma T3 values showed

evening values of plasma T_4 was lower in the control group and higher in the pinealectomized group than the morning values. These results show that pinealectomy reverses the daily changes of plasma T_3 and T_4. In coclusion, it can be said that the pineal may have an effect on thyroid function. Further studies are needed to establish this interaction exactly.

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