

Serum reverse triiodothyronine (rT_3) in children with goitre

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Serum reverse T_3 , T_3 , T_4 , and TSH concentrations were measured in children with goitre of grade II and III, and in controls of the same age. The average rT_3 level was decreased in both goitrous groups and the difference between them was significant. The rT_3/T_4 ratio in each group changed in a similar way. It seems that in goitre not only the T_3 secretion of the thyroid gland is increased but also the deiodination of T_4 to T_3 increases against rT_3 , or the degradation and metabolic clearance of T_3 and rT_3 change.

Measurement of thyroid hormones and their metabolites in serum is of importance in studies of the pathomechanism of goitre in children, and in addition in investigations of the hypophysis-thyroid axis.

3, 3' 5' triiodothyronine (reverse T_3 , rT_3) is a normal component of the human serum. It is formed by extra-thyroidal monodeiodination of thyroxine (T_4) besides an insignificant contribution by thyroidal secretion. Marked elevation of rT_3 in serum has been found in the cord blood of newborns and also in adults in various conditions. Elevation of the serum rT_3 level is frequently accompanied by a decrease in serum T_3 [2].

In patients with goitre the thyroid hormone levels may be affected due to iodine deficiency. This usually mani-

festes itself with an elevation of the serum triiodothyronine (T_3) and a decrease of serum T_3 [6]. It seemed therefore interesting to study the serum rT_3 level in children with goitre, together with a measurement of their serum T_3 , T_4 and thyrotropin (TSH) values.

MATERIAL AND METHODS

Children with goitre living in a slightly iodine deficient area of Hungary were investigated and their data were compared to the results obtained in a group of children without goitre from a non-goitrous area. Patients with goitre of grade II and III were investigated separately (25 and 13 children, respectively). The control group contained 11 subjects. The age of all children ranged from 6 to 10 years.

Serum T_4 and T_3 were measured by radioimmunoassay (RIA) RCC-kit (Amersham),

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the TSH serum level was investigated by the Phadebas TSH-kit (Pharmacia), and the serum rT_3 by Biodata ria-kit (Hypolab Co.).

RESULTS

The results of the hormone measurements are shown in Table I. The average serum TSH and T_3 levels were elevated, the mean serum T_4 concentration was decreased in both goitrous groups as compared to the controls.

The concentration of rT_3 in the goitrous groups was significantly decreased; a more marked decrease was found in the children with goitre of grade III.

The proportion of rT_3 and T_4 calculated in each patient is seen in Table II. The average ratio was significantly decreased in both goitrous groups, and the difference between them was significant statistically.

DISCUSSION

By means of a specific RIA, it was shown that rT_3 was a normal component of human sera [3]. Much of the T_4 secreted by the thyroid gland is metabolized by deiodination to T_3 and rT_3 . Most of the T_3 and nearly all of the rT_3 are produced in this way [4, 8]. Several investigators have reported that the serum rT_3 concentration is increased in patients with a variety of non-thyroidal diseases and in several conditions including hepatic cirrhosis, chronic renal failure, acute febrile disease, protein calorie malnutrition, corticosteroid therapy and surgical procedures [2]. The reverse T_3 level is also increased in cord and newborn serum as compared to the normal adult one [5]. An increased level was found in hyperthyroid patients and a decreased one in hypothyroid ones [7].

TABLE I
Serum TSH, T_4 , T_3 and rT_3 concentrations (mean $\pm$ S.D.)

Groups	(n)	TSH uU/ml	T_4 ug/dl	T_3 ng/ml	rT_3 ng/dl
Goitre grade II	25	$5.60 \pm 1.60^{***}$	$7.51 \pm 1.99^{**}$	$2.38 \pm 0.50^{**}$	$13.69 \pm 7.04^{***}$
Goitre grade III	13	$5.07 \pm 1.47^{**}$	8.48 ± 1.85^o	$2.61 \pm 0.44^{***}$	$7.93 \pm 6.36^{***}$
Control	11	3.56 ± 1.03	10.48 ± 1.77	2.04 ± 0.15	24.72 ± 7.25

t-test: **: $p < 0.01$; ***: $p < 0.001$; o: $p = 0.054$ (as compared to the controls).

TABLE II
Serum rT_3/T_4 ratio (mean $\pm$ S.D.)

Groups	rT_3/T_4 (ng/ug)
Goitre grade II	1.92 ± 1.03
Goitre grade III	1.05 ± 0.80
Control	2.39 ± 0.68

Elevation of rT_3 is frequently accompanied by a decrease in serum T_3 . This reciprocal alteration has led to the theory that the deiodination of T_4 is not a completely random process. The mechanism of this alteration is unknown.

On the other hand, it has been reported that in regions with iodine deficiency, low values of serum protein bound iodine (PBI) or serum T_4 are found together with the elevation in serum TSH [6]. With regard to the elevated serum T_3 concentration, the thyroid has been assumed to secrete preferentially T_3 in iodine deficiency [1]. Thyroid hormone concentration is, however, controlled not only by the regulation of thyroid secretion but also by deiodination of the extrathyroidal T_4 , and this change is reflected by the serum concentration of rT_3 as well as of T_3 .

In the present study the serum rT_3 concentration was significantly decreased in both goitrous groups and even more in the group of children with goitre of grade III. As to the cause of the decreased rT_3 level, we may suppose the responsibility of the decreased T_4 level in children with goitre, but a change in the ratio of T_4 deiodination to T_3 and rT_3 is also possible.

To clarify the question, the proportion of serum rT_3 and T_4 was calculated. The average ratio revealed significant alterations in the investigated

groups. It seems that not only the T_3 secretion by the thyroid gland is increased in children with goitre developed in consequence of a slight iodine deficiency, but either the deiodination of T_4 to T_3 increases against reverse T_3 , or the degradation and the metabolic clearance of the T_3 and rT_3 are also changed.

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