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EFFECTS OF THYROIDECTOMY ON THE SERUM PROTEIN FRACTIONS IN DOG

By:

N. Guiti and A. Pousti ✧

INTRODUCTION

Variations in the serum protein level in clinical hypothyroidism or after thyroidectomy have been reported by several authors, (3,6,9).

A number of investigators have observed a significant decrease in the albumin fraction (Abreu et al 1957, and Aschkensay 1960) and increase in gamma globulin (Moor 1945, and Boas 1955) after thyroidectomy.

Because of the role of plasma alpha globulin and albumin as the thyroid hormone-carrier (thyroxine-binding-protein) to the tissues (Anderoli et al 1961) and because of some discrepancies in the results reported so far on the alteration of the plasma protein fractions in the course of human spontaneous hypothyroidism (Atlas et al 1950), we decided to study the effect of thyroidectomy on the dog serum protein fraction.

METHODS

A total of 29 puppies of both sexes and weighing 2.5-7 kg were thyroidectomized under anesthesia induced by I.V. injection of 30-40 mg/kg Pentobarbital (Nembutal).

Serum electrophoresis was performed before and then every week after thyroidectomy until the spontaneous death of the animals.

✧ Department of Experimental Medicine and Pharmacology, University of Tehran, Iran.

The two superior (external) parathyroid glands were carefully dissected so that the glands and their blood supply were preserved.

Gross post-mortem examination showed no visible remains of thyroid tissue at the site of operation.

All the animals were kept in separate metal cages, fed ground meat, wheat bread and tap water ad libitum.

Blood samples were obtained in a fasting state from the peripheral veins (basilic or external saphena), the blood was allowed to clot and the clear serum was separated.

Paper electrophoresis was performed according to the conventional method (13) using a veronal sodium acetate buffer (PH=7.8).

The paper strip was developed with a solution of bromophenol blue and its optical density was determined by electronic densitometer (Model 52 - C).

The variable response electronic recorder (Varicord Model 428, Photovolt corp) and the Automatic Integrator (Model 49, Photovolt corp) were used for automatic recording of the electrophoretogram and integration of the area under the curve.

Total serum protein was determined by the Peters - Van Slyke method (8).

RESULTS

A summary of data is shown in the Table I and illustrated in Fig I.

The significant decrease of albumin fraction in the thyroidectomized animals after three weeks and a significant increase in the relative amount of gamma-globulin were the noteworthy findings.

The alpha 2 component showed a significant increase in the third week but the beta 1 and beta 2 globulin fractions were not significant at all. The alpha 1 globulin remained unaltered.

The clinical symptoms which were developed in association with the above electrophoretic alterations were chronologically as follow:

The average body weight decreased 5% at the first week and increased 15% at the third week.

The exophthalmos was observed in 17% of the cases 23-40 days after thyroidectomy (Fig. II) and hair loss was developed in 20% 11-67 days after operation.

DISCUSSION

The average values of the serum protein fractions obtained in our control dogs agree with those reported by De Weal and Lewis (7,10).

The significant fall of albumin fraction concomitant with elevation of the total globulin as gamma globulin fraction in the thyroidectomized dogs are in accordance with the similar changes reported in the thyroidectomized rat (Boas 1955) and in the human hypothyroidism (4).

The increase of beta 1 and beta 2 globulin fraction although was inconsistent and non significant in our experiments but the same changes have been reported by Atlas and Mahaux (4,11) in the clinical cases of myxedema.

A high elevation of the serum globulins despite the concomitant decrease of the serum albumin has caused a significant increase of the total serum protein in the third week following thyroidectomy.

Two possible explanations can be given for the electrophoretic changes on the basis of experimental therapeutic trials:

- 1- Direct effect of the deprivation of the thyroid hormones.
- 2- Indirect effect of a compensatory increase of T.S.H.

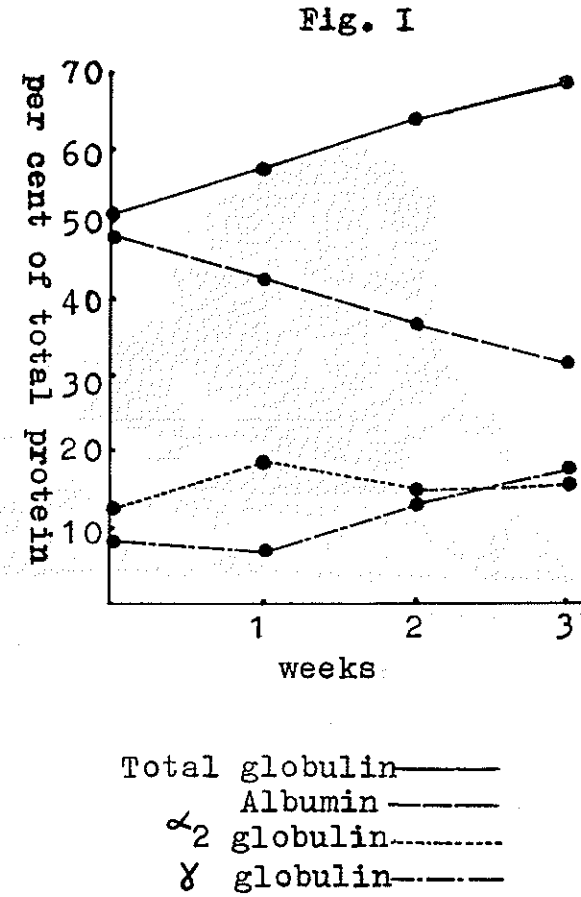
Considering the direct stimulating effect of the thyroid hormones on the cellular metabolism it seems very likely that decrease of the serum albumin is caused by the absence of the thyroid hormones, while increase of the serum globulin can be accounted for by the uninhibited hypersecretion of T.S.H, which influences possibly the biosynthesis of the glycoprotein and globulin fraction. The weight loss in the first week was possibly caused by post-operational anorexia. Increase in weight in the following weeks associated with hair fall were probably caused by thyroid deprivation and myxedema.

Development of exophthalmos in the thyroidectomized dogs was an unquestionable evidence of a compensatory hypersecretion of an anterior pituitary hormones whatsoever be (TSH, LATS, EPS).

Table I
Serum protein fractions in normal and thyroidectomized dogs

Fractions	Normal (29 dogs)	First week (29 dogs)	Second week (15 dogs)	Third week (11 dogs)	P
Albumin %	m±S.D. 48.56±10.41	m±S.D. 42.34±12.37	m±S.D. 36.12±10.71	m±S.D. 31.59±8.19	<0.001
α_1 Globulin %	7.69±4.13	7.54±4.8	8.36±5.1	7.45±5.44	>0.80
α_2 " %	12.58±5.78	18.57±8.58	14.82±4.72	16.2±3.62	<0.05
β_1 " %	10.36±4.18	11.65±6.97	11.14±3	11.94±4.1	>0.30
β_2 " %	12.9±4.16	11.68±4.60	15.58±6.5	15.7±4.46	<0.05
γ " %	8.51±0.173	7.81±3.22	13.49±5.78	17.05±6.08	<0.001
Total " %	50.99±10.36	57.32±12.55	63.72±10.52	68.26±8.03	<0.001
Total protein g%	4.2±0.609	4.17±0.574	4.29±0.583	5.04±0.754	<0.001
A/G ratio	1.01±0.479	0.79±0.41	0.599±0.877	0.47±0.21	<0.001

* % of total protein





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The study on the serum protein electrophoresis following thyroidectomy in puppies showed a significant decrease in the albumin and $\frac{A}{G}$ ratio associated with a relative increase in gamma and total globulin, but alterations of alpha I and beta globulin were not statistically characteristic in our thyroidectomized dogs.

Resumé

L'étude électrophorétique du sérum des chiens thyroïdectomisés a montré une chute significative du sérum albumin et rapport associée $\frac{A}{G}$ avec augmentation relative des valeurs de gamma et total globulin.

La physiopathologie des changements des fractions protéiniques du sérum sanguin associées avec les signes de myxédème thyroïdectomisé et exophtalmie est discutée.

Acknowledgement

The authors wish to acknowledge the valuable technical assistance of Miss M. Kazemi and Mrs. P. Zamani.

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