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TRIIODOTHYRONINE UPTAKE TEST IN GYNECOLOGIC RADIATION THERAPY

by

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The results of the triiodothyronine uptake test are influenced both by the amount of circulating thyroid hormones and by the availability of thyroxine-binding proteins in plasma. Changes in the uptake are thus caused either by agents affecting protein synthesis or by factors that alter, directly or indirectly, the function of the thyroid gland. Whole body irradiation leads to decreased uptake in rats (HAHN 1967). Exogenous factors such as stress and drugs have been found to affect the values in man (SISSON 1965). The present authors were therefore interested in finding out whether gynecologic radiation therapy can alter these values, especially as triiodothyronine is known to potentiate the radiation sensitivity of selected local tissues (GRIEM & STEIN 1960).

Material and Method. The material comprised 13 women aged from 40 to 76 years, who received radium and telecobalt therapy for genital carcinoma. The first plasma sample was taken just before treatment and the second immediately after removal of the radium applicators. The third sample was obtained in connection with the gynecologic examination at the end of telecobalt therapy. The radiation doses given are presented in the Table.

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Table

Diagnoses, age, radiation doses and triiodothyronine test values

Case	Diagnosis	Age	Radium therapy, mgh		Tele-cobalt, rad	Triiodothyronine test		
			1st appl.	Total		Before treat-ment	After 1st appl.	After treat-ment
1	Ca corp. uteri gr. I	76	2750	5750	3600	27.1	28.0	26.1
2	Ca corp. uteri gr. I	56	3600	6300	3850	27.5	28.5	25.6
3	Ca cervicis ut. gr. I b	63	2940	6160	3850	28.9	33.4	31.9
4	Ca cervicis ut. gr. II b	47	3240	6920	3850	34.0	33.8	28.6
5	Ca cervicis gr. II a	65	3220	4900	3920	27.1	33.1	25.7
6	Ca corp. ut. gr. II Ca mammae l.a.	75	3080	6080	3960	30.7	32.0	29.5
7	Ca in situ portionis St. post amp. uteri c. adnex.	59	2520	2520	—	31.5	36.0	27.6
8	Ca in situ cervicis	43	1800	3300	—	24.0	25.8	19.5
9	Ca corp. ut. gr. III	49	3600	7500	3750	32.1	35.1	32.0
10	Ca in situ cervicis	60	3360	7140	—	26.5	30.4	28.4
11	Ca cervicis gr. I a	51	3360	6730	3750	28.2	36.5	26.8
12	Ca cervicis gr. II a	40	3960	7180	4550	31.1	37.2	30.3
13	Ca cervicis gr. III	67	3200	3200	5400	30.9	—	27.0
					Mean	29.2	32.5	27.6
					SD	±2.8	±3.5	±3.4

The triiodothyronine resin uptake test was performed according to WOLDRING et coll. (1961), except that triiodothyronine labelled with ^{125}I (Radiochemical Centre, Amersham, England) was used. All the samples from the same patient were examined simultaneously. Student's t-test was applied for evaluation of the significance of differences between paired observations.

Results

The results are given in the Table. There is a small but significant ($P < 0.001$) increase (difference $\pm$ SD $= +3.4 \pm 2.6$) in the triiodothyronine uptake following radium application. This is followed by a significant ($P < 0.001$) decrease (-4.8 ± 2.8) to values (27.6 ± 3.4) significantly lower ($P < 0.05$) than those before therapy (29.2 ± 2.8). These results indicate that gynecologic radiation therapy can cause changes in the triiodothyronine uptake: an initial rapid increase is followed by a post-treatment decrease to values lower than the original.

Discussion

Several mechanisms may be responsible for the changes observed in the triiodothyronine uptake test during gynecologic radiation therapy. The direct effect of radiotherapy on the thyroid gland hardly ever enters into the question as the amount of scatter radiation received by this gland in the treatment of genital carcinoma is fairly small. As no PBI values were available it is difficult to say whether the changes that occurred were in the amount of circulating hormones or in the thyroxine-binding proteins. It is possible that while blood circulates in the organs given irradiation the structure of the plasma proteins changes and the thyroid hormone-binding capacity decreases. This could be the reason for the elevation of the triiodothyronine uptake observed during treatment.

The increase may on the other hand be due to acute stress caused by the application of radium which leads to an increase in the production of ACTH and also that of TSH in the pituitary gland (HARRIS 1955). This explanation would seem to be in agreement with earlier observations (GRÖNROOS & KAUPPILA 1959, SOIVA et coll. 1959) in test animals that increased gonadal function in acute stress, and decreased function in prolonged stress, may be attributable to changed production of gonadotrophins by the anterior lobe of the hypophysis. If the release of TSH is correlated with gonadotrophin production, the latter mechanism also explains the decrease in triiodothyronine uptake after radiotherapy to below the pre-therapeutic level. However, the decrease appears to be so slight as to be of any significance in the metabolism and for the therapeutic results.

SUMMARY

Gynecologic radiation therapy may cause small changes in the triiodothyronine uptake. An initial significant increase is followed by a significant decrease to values lower than those before therapy. The reason for this and the significance of the changes are discussed.

ZUSAMMENFASSUNG

Gynäkologische Strahlenbehandlung kann kleine Veränderungen in der Aufnahme von Triiodothyronin verursachen. Zuerst erfolgt eine signifikante Zunahme und dann eine starke Abnahme bis zu Werten, die niedriger sind als die bevor der Bestrahlung. Die Ursache und die Bedeutung dieser Erscheinungen werden besprochen.

RÉSUMÉ

Le traitement de lésions gynécologiques par les radiations peut causer de petites modifications dans la fixation de la triiodothyronine. Cette fixation augmente d'abord de façon importante jusqu'à des valeurs inférieures à celles qui existaient avant le traitement. Les auteurs examinent les raisons et l'intérêt de ces modifications.

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