

Investigation of the Region of Interest by Computed Tomography for Subclinical Hypothyroidism

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Abstract: We retrospectively investigated all of the patients who were evaluated for their thyroid function and underwent thoracic computed tomography (CT) in the emergency department of Juntendo University Hospital between April 2011 and April 2013. The subjects were divided into two groups: the SH group included subjects who received a diagnosis of subclinical hypothyroidism (SH), while the Control group included subjects who had a normal thyroid function. The definition of SH was a normal-range free T4 level and thyroid-stimulating hormone (TSH) over 5 mIU/L. The patients' age, sex, underlying diseases and values of TSH, free T3, free T4 as well as the average CT value of both thyroid glands and the presence of contrast between the thyroid gland and sternocleidomastoideus muscle were compared between the two groups. There were 5 subjects in the SH group and 22 in the Control group. There were no significant differences between the two groups with regard to the age, sex, underlying diseases or level of free T4. However, the level of free T3, CT value and the frequency of positive contrast between the thyroid gland and sternocleidomastoideus muscle in the SH group were significantly smaller than in the Control group, while the level of TSH in the SH group was significantly greater than in the Control group. This is the first study to demonstrate a low density of the thyroid gland in patients with SH. Even the accidental detection of SH by CT may be useful for managing patients.

Keywords: computed tomography; subclinical hypothyroidism; diagnose.

INTRODUCTION

Subclinical hypothyroidism (SH) is a biochemical diagnosis defined by a normal-range free T4 level and an elevated thyroid-stimulating hormone (TSH) level. Patients may or may not have symptoms attributable to hypothyroidism[1]. In a prospective study of 107 patients older than 55 years of age, an initial TSH level greater than 10 to 15 mIU/L was the variable most strongly associated with progression to overt hypothyroidism. Treatment with levothyroxine should be considered for patients with initial TSH levels greater than 10 mIU/L, patients with elevated thyroid peroxidase antibody titers, patients with symptoms suggestive of hypothyroidism and TSH levels between 5 and 10 mIU/L and patients who are pregnant or are attempting to conceive[1].

Recently, computed tomography (CT) has been used for the diagnosis of a variety of diseases[2,3]. Estimating the CT value of the thyroid may therefore also be useful for the diagnosis of a range of thyroid

conditions[4,5]. However, the CT values indicating SH remain unclear.

We therefore retrospectively investigated the CT values for SH patients.

METHODS

The protocol of this retrospective study was approved by our institutional review board, and the examinations were conducted according to the standards of good clinical practice and the Declaration of Helsinki.

We retrospectively investigated all of the patients who had their thyroid function evaluated and underwent thoracic CT in the emergency department of Juntendo University Hospital between April 2011 and April 2013. The subjects were divided into two groups: the SH group included subjects who received a diagnosis of SH, while the Control group included subjects who had a normal thyroid function. The definition of SH was a normal-range free T4 level and

thyroid-stimulating hormone (TSH) over 5 mIU/L. The patients' age, sex, underlying diseases and values of TSH, free T3, free T4 as well as the average CT value of both thyroid glands and the presence of contrast between the thyroid gland and sternocleidomastoideus muscle (Figure 1) were compared between the two groups.

The data were analyzed using Student's unpaired *t*-test and the chi-squared test. P values of <0.05 were considered to indicate statistical significance.

RESULTS

There were 5 subjects in the SH group and 22 in the Control group. There were no patients in the SH group who received thyroid hormone as treatment. Table 1 shows the results of underlying diseases in the two groups. Table 2 shows the results of an analysis between the two groups. There were no significant differences between the two groups with regard to the age, sex, underlying diseases or level of free T4. However, the level of free T3, CT value and the frequency of positive contrast between the thyroid gland and sternocleidomastoideus muscle in the SH group were significantly smaller than in the Control group, while the level of TSH in the SH group was significantly greater than in the Control group.

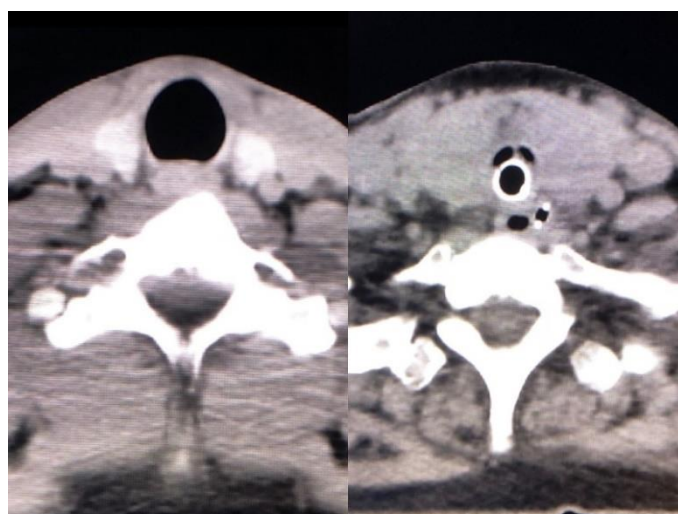


Fig-1: Thyroid gland on computed tomography. A normally functioning thyroid shows high density compared with the surrounding tissue (left). Under conditions of hypothyroidism, the thyroid gland shows low density and loses contrast with the surrounding tissue (right).

Table-1: Underlying disease

Control	n	Subclinical hypothyroidism	n
Syncope	8	Gastroenteritis	1
Pneumonia	2	Pneumonia	1
Constipation	2	Constipation	1
Vertigo	2	Leukemia	1
Autoimmune hepatitis	1	Brachial fracture	1
Vascular disease	1		1
Dehydration	1		
Dementia	1		
Palpitation	1		
Parkinson	1		
Periodic paralysis	1		
Post SAH	1		

SAH: subarachnoid hemorrhaging

Table-2: Results of analyses

	Control n = 22	Subclinical Hypothyroid n = 5	p value
Age	66.4 ± 3.5	79.2 ± 5.2	n.s.
Sex (Male/Female)	11/11	1/4	n.s.
TSH	1.9 ± 0.1	6.2 ± 0.9	< 0.0001
Free T3	2.8 ± 0.0	1.9 ± 0.3	0.001
Free T4	1.2 ± 0.0	1.1 ± 0.0	n.s.
CT value	116.8 ± 4.3	85.5 ± 8.3	0.005
Contrast (no/yes)	2/20	4/1	0.03

CT: computed tomography

DISCUSSION

This is the first study to demonstrate a low density of the thyroid gland in patients with SH. Chronic iodine intake deficiency can result in the induction of SH[6]. In addition, hypothyroidism is known to decrease the uptake of iodine and thereby reduce the production of thyroid hormone [2]. While, iodine has enhanced effect of organs on the CT by blocking or limiting the ability of x-rays to pass through[7]. Accordingly, we did not measure the iodine level of the thyroid gland directly, but the low CT value of the thyroid gland in the present study may reflect the low density iodine of the thyroid gland.

Clinical symptoms of hypothyroidism are nonspecific and may be subtle, especially in older individuals[1]. However, SH may be associated with coronary heart disease events, heart failure, cognitive impairment, depression or fractures [8]. Accordingly, even the accidental detection of SH by CT may be useful for managing patients.

Some of the limitations associated with this study include its retrospective design and the small number of cases. In addition, level of thyroid hormone in the subjects, who were treated in the emergency department, might be influenced by a variety of stressors. Therefore, future prospective studies involving a larger number of patients are needed in order to further examine this issue.

CONCLUSION

This is the first study to demonstrate a low density of the thyroid gland in patients with SH. Even the accidental detection of SH by CT may be useful for managing patients.

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Conflict of Interest

The authors declare no conflicts of interest in association with the present study.

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