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Sonographic and functional characteristics of thyroid nodules in a population of adult people in Isfahan

Cechy sonograficzne i ocena czynności guzków tarczycy w dorosłej populacji Isfahanu

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Abstract

Introduction: The aim of this study was to investigate the current status of sonographic characteristics of thyroid nodules in Isfahan, a previously iodine deficient area in central Iran.

Material and methods: In a cross-sectional study conducted in 2006, 2523 adult people (age > 20 years) were selected by a multistage clustering sampling method. Of these people, 263 volunteered persons were underwent sonographic evaluation. Thyroid examination was done by two expert sonographers. Serum T_3, T_4, T3RU, TSH, TPO Ab and Tg Ab, and urinary iodine were measured.

Results: Forty-six per cent of the 263 people were women. Their mean age was 35.5 years with a range of 20-64 years. Median urinary iodine was 19.4 μg/dL. The prevalence of thyroid nodules on sonography was 22.4% in the whole group; 30% in women and 16.3% in men (OR = 2.2, P = 0.01). The prevalence of thyroid nodules increased with age (P = 0.006). The prevalence of thyroid nodules was higher in hypothyroid people than in euthyroid people (35.1% *v.* 20.5%, OR = 2.1, P = 0.04). Neither urinary iodine nor autoantibody concentrations correlated with the prevalence of thyroid nodules in sonography.

Conclusions: The prevalence of thyroid nodule by sonography is still high despite relatively normal urinary iodine in this population. **(Pol J Endocrinol 2010; 61 (2): 188–191)**

Key word: *nodular goiter, autoimmunity, sonography, iodine, Iran*

Streszczenie

Wstęp: Celem badania była ocena cech sonograficznych zmian ogniskowych tarczycy u mieszkańców Isfahanu, obszaru w cenralnym Iranie, który wcześniej charakteryzował się niedoborem jodu.

Materiał i metody: W przekrojowym badaniu przeprowadzonym w 2006 roku wybrano próbę liczącą 2523 dorosłych osób (wiek > 20 lat) metodą wielostopniowego losowania grupowego. Spośród tej grupy, 263 ochotników poddano badaniom sonograficznym. Badanie tarczycy przeprowadzili doświadczeni specjaliści w zakresie ultrasonografii. Ponadto oznaczono stężenia T_3, T_4, T3RU, TSH, TPO Ab i Tg Ab w surowicy oraz wydalanie jodu z moczem.

Wyniki: Kobiety stanowiły 46% grupy poddanej badaniom sonograficznym (n = 263). Średnia wieku wynosiła 35,5 lat (zakres 20–64 lat). Mediana stężenia jodu w moczu wynosiła 19.4 μg/dl. Obecność zmian ogniskowych tarczycy wykazano w badaniu sonograficznym u 22,4% osób z badanej grupy; u 30% kobiet i 16,3% mężczyzn (OR = 2,2; p = 0,01). Częstość występowania zmian ogniskowych tarczycy zwiększała się z wiekiem (p = 0,006). Zmiany ogniskowe tarczycy występowały częściej u osób z niedoczynnością tarczycy niż w grupie z eutyreozą (35,1% *v.* 20,5%, OR = 2,1; p = 0,04). Nie stwierdzono korelacji między stężeniem jodu w moczu ani stężeniem autoprzeciwciał a występowaniem zmian ogniskowych tarczycy w badaniu sonograficznym.

Wnioski: Częstość występowania zmian ogniskowych tarczycy oceniana na podstawie wyników badania sonograficznego jest nadal duża w badanej populacji, mimo prawidłowego stężenia jodu w moczu. **(Endokrynol Pol 2010; 61 (2): 188–191)**

Słowa kluczowe: *wole guzkowe, autoagresja, sonografia, jod, Iran*

Introduction

Epidemiological data show that thyroid disorders such as goiter, nodularity, and hyperthyroidism are more common in areas of long-standing iodine deficiency. After iodine supplementation, it is supposed that some of these thyroid disorders should be decreased [1–7].

Ultrasonography is useful for several aspects of thyroid gland investigation, including measurement of size, and finding nodularity and echogenicity [8, 9]. Although

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the majority of nodules are benign, the risk of malignancy is about 1.5–10%, depending on ethnicity, age, sex, and sonographic and clinical characteristics [10].

Iran used to be an iodine-deficient area before the 1990s; median urinary iodine before iodization was less than 10 mg/dl in most regions of Iran. At that time, the prevalence of nodular goiter had not been investigated by sonography, although the goiter prevalence was high.

At that time, the national salt iodization program (with 40 mg per one kilogram of salt) was initiated for the general population [11, 12]. Despite a comprehensive program, less than 50% of the households in rural areas consumed iodized salt by 1994. Therefore, the mandatory production of iodized salt for households began in 1994. Seven years later, median urinary iodine in school children was 20.5 μg/dL; 85.1% had urinary iodine over 10 μg/dL. Median urinary iodine was more than 13 μg/dL in all 26 provinces [11, 19].

After more than one decade of iodine supplementation, median urinary iodine excretion seems to be within acceptable limits in our region, which indicates an improved iodine supply [13].

The aim of the present study was to evaluate the current status of sonographic and functional thyroid characteristics in a subpopulation in Isfahan, a central city of Iran, after 15 years of iodine supplementation in 2006.

Material and methods

This is a cross-sectional study, from January to April 2006, in Isfahan, an iodine-replete area of Iran, with about two million inhabitants. A total of 2600 adult males and females (age > 20 years) were invited to Isfahan Endocrine and Metabolism Research Centre (IEMRC) by means of random cluster sampling. Of the invited people, 2523 (97%) persons accepted the invitation and came to IEMRC for evaluation. Consent was obtained from all participants. The Medical Ethics Committee of Isfahan University of Medical Sciences approved the study protocol which complied with the Helsinki Declaration. Details of the main study have recently been published [14].

Of these 2523 participants, 263 volunteered persons underwent sonographic evaluation. Thyroid function tests including TSH, T_3, T_4, and T3RU were carried out in all subjects.

The normal range of serum TSH was 0.3–4 mIU/L, serum T_4 was 4.5–12 mg/dL, and serum T_3 was 80––190 ng/dl. The normal range of T3RU was 25-35%.

Free T_4 Index (fT_4I) was calculated by T_4 x T3RU, Its normal range was 1.3–4.8 mg/dL.

Thyroid status was defined as euthyroid when all TSH, T_4, T_3, and FT_4I levels were within the normal range; Hypothyroidism, when TSH level was more than 4 mIU/L and T_3 and/or T_4 and/or fT_4I was less than the lower limit of the normal range; Subclinical hypothyroidism, when serum TSH was more than 4 mIU/L and, T_4, T_3, and fT_4I were within the normal range; Hyperthyroidism, when serum TSH level was less than the lower limit of the normal range and T_4 and/or T_3 and/or fT_4I was above the normal range; Subclinical hyperthyroidism, when TSH level was less than 0.3 mIU/L and normal T_4, T_3, fT_4I.

Serum TPO Ab and Tg Ab levels were measured in 86 out of 263 people. Values of TPO Ab above 75 IU/L and Tg Ab above 100 IU/L were considered positive.

Urinary iodine concentration was measured in 211 out of 263 people. Iodine deficiency was defined as a median of urinary iodine concentration of less than10 mg/dL.

Thyroid ultrasonography was performed with HS-2000 Honda Ultrasound equipment with 7.5 MHZ, Linear probe. The subjects were examined in a supine position with hyperextend neck, statistical analysis: As Anti Tg, Anti TPO, TSH, and urinary iodine concentration were not distributed normally, so they were reported as median and compared between groups by Mann-Whitney test. Normally distributed data were reported as mean and standard deviation. We used the t-test to compare the two groups. We used odds ratio (OR) and 95% confidence interval (CI) when appropriate, and we used the Chi-square test to investigate the correlation between qualitative variables.

Statistical analysis was carried out using SPSS software, Version 13. P-values less than 0.05 were considered statistically significant.

Results

Of 263 people who underwent sonographic evaluation of the thyroid, 54% were male, 46% were female, and mean age was 38.5 (10.9) with the range 20 to 64 years.

Urinary iodine was measured in 211 out of 263 participants at random. The median of their urinary iodine was 19.4 mg/dL. It was 18 mg/dL in men and 22 mg/dL in women, the difference was not statistically significant. There was no difference between the urinary iodine excretions in different age groups.

The prevalence of thyroid nodules, by sonography, in 263 people was 22.4%. Thirty persons (11.4%) had one thyroid nodule and twenty-three (8.7%) had multinodules. The prevalence of thyroid nodules on sonography was 30% in women and 16.3% in men (OR = 2.2, P = 0.01).

The prevalence of thyroid nodules was age-dependent, as shown in Table I. There was no relationship between the number of nodules and age.

According to sonographic data, 58.5% of nodules were hypoechoic, 15.1% of nodules were hyperechoic,

Table I. *Prevalence of thyroid nodules, according to age group, in adult people who underwent sonography in Isfahan, Iran, in 2006*

Tabela I. *Występowanie zmian ogniskowych tarczycy w zależności od grupy wiekowej w dorosłej populacji Isfahanu (Iran) badanej sonograficznie w 2006 roku*

Age groups (Years)	Thyroid nodule in sonography		Total
	Yes No. (%)	No No. (%)	
21–24	3 (5.1%)	28 (13.9%)	31 (11.9%)
25–29	6 (10.2%)	22 (10.9%)	28 (10.7%)
30–34	3 (5.1%)	25 (12.4%)	28 (10.7%)
35–39	3 (5.1%)	28 (13.9%)	31 (11.9%)
40–44	15 (25.4%)	37 (18.3%)	52 (19.9%)
45–49	9 (15.3%)	32 (15.8%)	41 (15.7%)
≥ 50	20 (33.9%)	30 (14.9%)	50 (19.2%)

P = 0.006

Table II. *Thyroid status of Isfahan adult people with and without nodules, who underwent sonography in Iran in 2006*

Tabela II. *Czynność tarczycy ze zmianami ogniskowymi i bez u dorosłych mieszkańców Isfahanu (Iran) badanych sonograficznie w 2006 roku*

Thyroid function	With nodule [n (%)] 59 (22.6)	Without nodule [n (%)] 202 (77.4)
Euthyroid	44 (74.6)*	179 (88.6)
Subclinical hypothyroidism	6 (10.2)*	11 (5.4)
Clinical hypothyroidism	6 (10.2)*	12 (5.9)
Hyperthyroidism	2 (3.4)*	0 (0)

* P = 0.007

and 3.8% had calcification in sonography. There was no difference in echogenicity of nodules or calcification between men and women.

When we included thyroid function status, the frequency of thyroid nodules increased with hypothyroidism (P = 0.007) (Table II).

There was no difference between autoimmunity and iodine status in persons with and without thyroid nodules at sonography.

Serum TSH, T_4, and T_3 were measured in all 263 people. Their thyroid function is shown in Table III. There was no correlation between age and serum TSH concentration.

TPO Ab and Tg Ab levels were measured in 86 out of 263 persons. Positive TPO Ab was observed in 30.6% and 32.6% of men and women, respectively. Positive Anti TgAb was gender-dependent. It was 11.1% in men and 30.0% in women (OR = 3.43, P = 0.03). The distribution of increased TPO Ab and Tg Ab was not age-dependent.

Table III. *Prevalence of thyroid abnormalities in Isfahan adult people who underwent sonography in Iran in 2006*

Tabela III. *Występowanie zaburzeń czynności tarczycy w dorosłej populacji Isfahanu (Iran) badanych sonograficznie w 2006 roku*

Thyroid status	Men n (%) 142 (54)	Women n (%) 121 (46)	P
Euthyroid	128 (90.1)	97 (80.2)	0.02
Subclinical hypothyroidism	8 (5.6)	9 (7.4)	0.10
Clinical hypothyroidism	5 (3.5)	13 (10.7)	0.02
Subclinical hyperthyroidism	1 (0.7)	1 (0.8)	0.10
Clinical hyperthyroidism	0 (0.0)	1 (0.8)	0.10

Discussion

A sample of 2523 persons of the general population in Isfahan, a central city in Iran, was investigated [14]. The present study is a report of thyroid nodule prevalence detected by ultrasonography in a subgroup of that large studied population. Isfahan used to be iodine deficient until the 1990s when dietary salt was supplemented with iodine. The current intake of iodine in this city is now sufficient [14, 15].

The prevalence of clinical and subclinical hypothyroidism was 6.5% and 6.9% in the studied subpopulation, respectively. This is not consistent with some other studies [16]. Several studies have shown that autoimmune hypothyroidism is more prevalent in iodine-replete areas [17, 18]. Positive Tg Ab was more prevalent in women, who had more thyroid nodules than men. These data suggest that autoimmunity may be the cause of thyroid disorders in this iodine sufficient area, something which should be evaluated by further studies.

The prevalence of thyroid nodules at 22.4% is consistent with other reports of thyroid nodules in sonography [19, 20]. However, thyroid incidentaloma (normal in physical examination) was 13.2% in the Isfahani population [21]. Most of the nodules were not malignant, but could pose a risk of malignancy later in life [22].

Thyroid nodules were more prevalent in older participants. This suggests that, although iodine-deficiency predisposes thyroid disorders including nodules, supplementation with iodine did not diminish thyroid nodules. Prospective studies have shown that iodine supplementation does not decrease the incidence of

thyroid nodules in some areas [10]. This could be the result of anatomical changes made by long-standing iodine deficiency which is not expected to be resolved by iodine supplementation.

We do not have any data about the prevalence of thyroid nodules by sonography in our region before iodine-supplementation with which to compare with this data. However, this study shows that with increasing median urinary iodine, the prevalence of thyroid nodules tends to decrease in the population, although this was not statistically significant. This might indicate a beneficial effect of iodization, which can decrease nodules of the thyroid but cannot eradicate the nodules. The role of some other factors, such as autoimmunity, should also be considered regarding the aetiology of nodular formation in the thyroid. However, our sample size was not large enough to show the relationship between autoimmunity and thyroid nodules.

The limitation of our study did not compare the prevalence of thyroid nodules by sonography before and after iodine supplementation due to lack of data before iodization and small sample size.

Conclusions

The prevalence of thyroid nodules by sonography is in accordance with most iodine sufficient areas of the world. However, there are other factors like autoimmunity, genetics, and unknown causes. In future, all of the factors relating to thyroid nodules should be evaluated in our country with a bigger sample size, and prophylactic parameters should be found regarding thyroid nodule formation.

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