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SHORT COMMUNICATION

Impact of tobacco smoking on thyroid ultrasound image assessed among random population of spa patients in Kołobrzeg, Poland

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ABSTRACT

Tobacco smoking increases the risk of many diseases, but its association with thyroid disorders remains unclear. Most studies show higher incidence of thyroid nodularity in the populations of smokers. Due to its pro-inflammatory effect, tobacco is said to play an important role also in the development of thyroid inflammation. However, our study showed opposite results. We performed a research on a population of 75 spa guests in Poland. The study was based on surveys and ultrasound thyroid examination. Among examined patients, thyroid nodularity was more common in non-smokers than in smokers. Focal changes were detected in 25,00% of smokers and in 48,00% of non-smokers. Examined smokers presented also less abnormalities in the thyroid echogenicity. Heterogenous thyroid echogenicity was detected in 40,00% of smokers and in 52% of non-smokers. 49,21% of the examined population had enlarged thyroid gland. Among the group with enlarged thyroid gland only 24,30% were smokers and 75,70% were non-smokers. Such results can be explained by a small study group of

patients. Another aspect is the type of the group- it turned out, that most of the patients who were interested in participation in the study, presented thyroid diseases in the past.

Keywords: thyroid, thyroid volume, thyroid nodules, goiter, tobacco, cigarette smoking

1. INTRODUCTION

Tobacco is one of the most frequently used psychoactive substances in the world. It belongs to the biggest contributors to mortality and morbidity. Numerous studies show that cigarettes are considered as the most common source of toxic chemical exposure. Tobacco smoke contains about 7000 different chemical compounds, over 150 of which are described as harmful to human health. Tobacco [1,2].

The negative impact of tobacco use on pulmonary diseases is well known and proved in many studies. Lung cancer, chronic obstructive lung disease, frequent respiratory tract infections are often described in smokers.

Cardiology societies all over the world emphasize that cigarette smoking increases significantly the risk of myocardial infarction, cerebral stroke and vascular disease, as underlined in numerous publications.

Tobacco smoking plays also role in the pathogenesis of thyroid diseases. The toxic effect of cigarette smoke on thyroid gland is believed to be mostly due to the compound named thiocyanate- a derivative of hydrogen cyanide with a half-life over 6 days. It inhibits iodine uptake by the thyroid, causing a relative iodine deficiency. Thiocyanate also competes with iodine in the organification process, which leads to inhibition of thyroid hormone synthesis. Thiocyanate may be responsible for goiterogenic effect of cigarette smoking. Iodine deficiency enhances the antithyroid effect of thiocyanate. Thus, this effect of goiter formation in tobacco smokers might be more common in iodine deficient areas [3,4].

Nicotine contained in cigarettes has an opposite effect on thyroid gland. It is described as thyroid stimulant. Studies show that nicotine mimics the effect of acetylcholine at selected central nicotinic acetylcholinergic receptors, causing sympathetic activation and consequently increased thyroid activation [1,5,6].

Tobacco smoke causes hypoxia and formation of oxygen free radicals, which results in cell injury. Tobacco glycoprotein promotes also production of interleukines, activating inflammatory processes [7]. Thus, smoking may contribute to autoimmune thyroid diseases.

The incidence of autoimmune thyroiditis increases worldwide and smoking might be one of its trigger factors.

Many studies describe strict association of cigarette smoking and Graves' disease, also known as toxic diffuse goiter. It is an autoimmune disease, which is the most common cause of hyperthyroidism. The impact of smoking is even stronger on incidence of Graves' ophthalmopathy, an autoimmune inflammatory condition characterized by upper eyelid retraction, proptosis, edema and erythema [8-10].

The association between smoking and thyroid nodularity is still under debate. Most studies report an increase in multimodal goiter in populations of tobacco smokers. Lio et al reported higher incidence of multimodal goiter among women heavy smokers [11]. A Turkish population study performed by Aydin et al. described correlation between smoking and incidence of multimodal goiter in both sexes [12]. Similar to other negative effects of tobacco,

the association of thyroid multinodularity seems to exist predominantly in the areas of iodine deficiency [1, 12-14].

2. MATERIAL AND METHODS

The study was conducted during two weeks of free health consultations programme organised by Poznan University of Medical Sciences with cooperation of spa sanatorium Węgiel Brunatny in Kołobrzeg, Poland.

Participation in our study was voluntary. All patients who visited our endocrinology consulting room could take part in our study, regardless of the current state of health, gender, age, occupation and lifestyle habits. Spa guests, as well as spa workers and visiting medical students were patients in our project. Participation in the study was anonymous and personal data were collected with compliance to the data protection rules.

The study was conducted in a group of 75 patients. Each person who agreed to take part in our research was asked to fill a questionnaire about medical history, occupation, addictions and health habits. The questionnaire contained 22 questions, which were divided into two parts. After filling the survey, the thyroid ultrasound was performed. Each examination was conducted by an experienced sonographer. We assessed volume of the thyroid, its echogenicity, presence of nodules and other possible focal changes. All results of thyroid examination were collected in medical documentation.

The population of our patients was divided into two main groups: smokers and non-smokers. In the first place, we tried to find a correlation between smoking and thyroid abnormalities found in ultrasound examination. Secondly, we tried to assess the impact of sex, gender and age on the incidence of thyroid abnormalities that could be detected in ultrasound. After data collection, a thorough analysis with division into different groups was performed. The results and comments are shown in the following caption.

3. RESULTS

The questionnaire was collected from 75 people. Table number 1 presents the characteristics of the respondents. Most of them, as much as 87,78% were women and men accounted for 12,22%. The largest group of respondents were people aged 45- 54 and accounted for 29,00% of the study group. 20% of the examined population were patients in the age bracket from 55 to 64 years. Persons aged 65 and more constituted 19% and aged 35-44 years: 11,97%. The smallest age group were patients aged 18-24 (10,64%) and 25-34 years (9,39%). However, 3,99% of respondents did not agree to give their age.

The people participating in our survey were also diversified in terms of their status. 37,24% of them declared that they were a spa patient, 33,5% of them were spa employees and 10,65% of the respondents were medical university students. 18,62% of the respondents did not provide this data. Following part of the survey concerned the use of nicotine. Most of the responders were no-smokers and accounted for 73,33%. More than a quarter of the patients (26,67%) declared nicotine addiction.

Next question concerned the number of smoked cigarettes by the smokers. 35% of them declared smoking more than 20 cigarettes a day, 20% from 10 to 20 cigarettes a day and 15%

from 1 to 9 cigarettes a day. However, 30% of the smokers did not reveal the number of cigarettes smoked per day.

Table 1. Answers of the respondents to the metrics questions.

TOTAL		
GENDER	AMOUNT	%
Female	66	87,78%
Male	9	12,22%
AGE		
AGE RANGE	AMOUNT	%
18 - 24 years	8	10,64%
25 - 34 years	7	9,31%
35 - 44 years	9	11,97%
45 - 54 years	21	27,93%
55 - 64 years	14	18,62%
65 years and more	13	16,90%
STATUS		
STATUS TYPE	AMOUNT	%
Spa patients	28	37,24%
Spa employees	25	33,50%
No data	14	18,62%
Students	8	10,64%

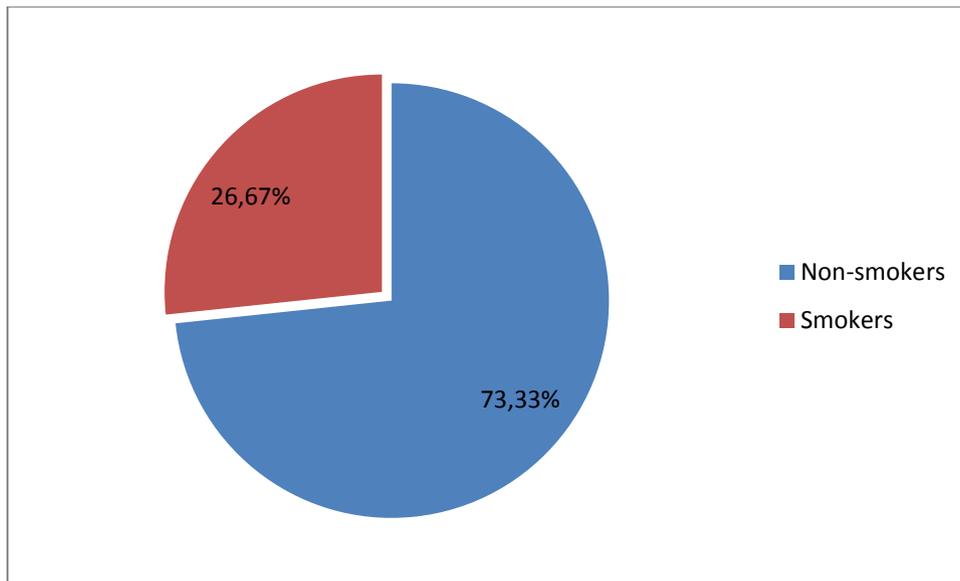
Source: own study based on data from the questionnaires

Next step of our study was the thyroid ultrasound examination. The volume of thyroid gland was measured. Thyroid volume norm for women is 18cm³ and for men 25cm³.

49,21% of the examined population had enlarged thyroid gland, whereas 41,48% presented normal thyroid volume. In 9,21% of the patients the volume was not measured.

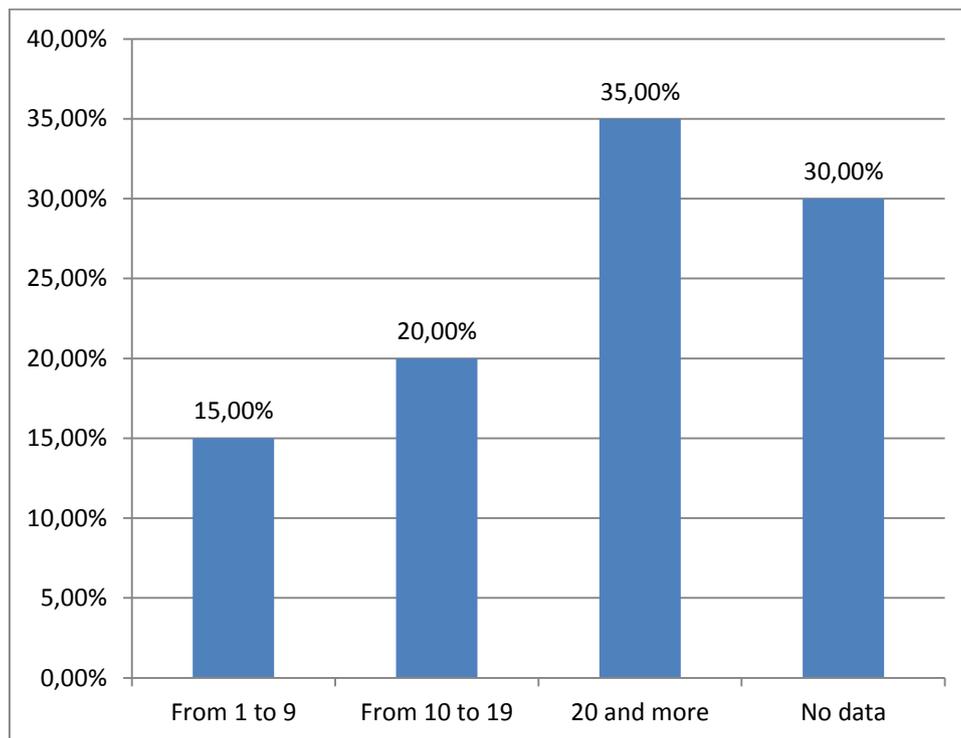
83,70% women and 16,3% men had enlarged thyroid volume. Among the group with enlarged thyroid gland only 24,30% were smokers and 75,70% were non-smokers.

Graph 1. Addiction to nicotine



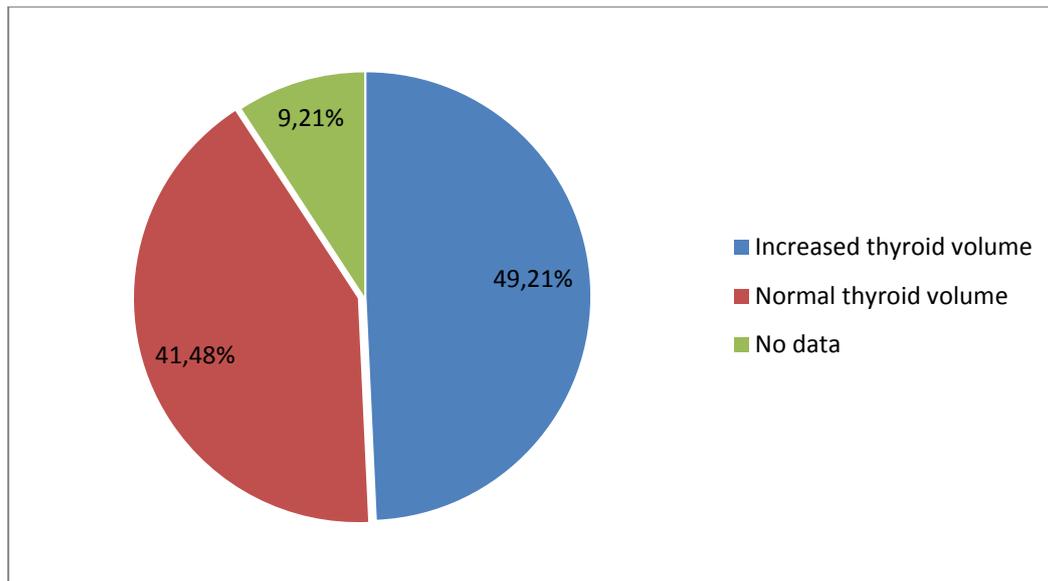
Source: own study based on data from the questionnaires

Graph 2. Number of cigarettes smoked per day



Source: own study based on data from the questionnaires

Graph 3. Thyroid volume



Source: own study based on data from the thyroid ultrasound.

During the ultrasound examination, focal changes were found in 25,00% of smokers and in 48,00% of non-smokers. Solid focal changes were detected in 20,00% of smokers and cystic focal changes were found in 10,00% of smokers. Among non-smokers, 38,00 % presented solid focal changes and 11,00% presented cystic focal changes.

Most of the smokers – exactly 60,00% had homogenous thyroid echogenicity in the thyroid ultrasound examination and only 40% of them presented heterogeneous (impaired) thyroid echogenicity. In the group of non-smokers only 48% had homogenous thyroid echogenicity, while the majority of them (52%) had heterogeneous thyroid echogenicity.

In the group of non-smokers, one person (1,83%) underwent partial thyroidectomy in the past, two people underwent a total thyroidectomy and one underwent radioactive iodine therapy. In total, among non-smokers, 7,32% had thyroid intervention. 5,00% of smokers and 9,00% of non-smokers were on oral thyroid hormone supplementation therapy at the moment of ultrasound examination.

4. CONCLUSIONS

Most of the patients who took part in the study were non-smokers. 49,21% of the examined population had enlarged thyroid gland and 75% of them were non-smokers. The study revealed focal changes in 25,00% of smokers and in 48,00% of non-smokers. Thus, there was a much greater incidence of thyroid nodularity in the non-smoking group of patients. Among the smokers, 40,00% had heterogeneous thyroid echogenicity and 52% of non-smokers had heterogeneous echogenicity in ultrasound.

The research showed more abnormalities in thyroid volume, echogenicity and changes in thyroid tissue in the group of non-smokers. Secondly, also more non-smokers had surgical

interventions or thyroid radiation in the past. More non-smokers than smokers from our research group were taking oral thyroid hormone supplementation therapy. In the group of smokers the presence of thyroid abnormalities was less common. However, our research was made on a small population, what can explain such surprising results. Secondly, it turned out that the majority of volunteers interested in our study were patients who suffered from thyroid diseases in the past. A large population study performed a group of Danish researchers showed opposite results to ours. Knudsen et al. detected higher occurrence of thyroid multinodularity in the group of smokers [16]. Bigger studies should be performed also in our country to show whether smoking can play a protecting role in the incidence of thyroid diseases in Polish population.

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