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# Evaluation of the Relationship between Occupational Working Time in Radiology Technicians, Presence of Thyroid Nodules and Hormone Parameters: A Single Center Study

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**ABSTRACT**

In our study, we evaluated the relationship between the duration of professional work in radiology technicians, the presence of thyroid nodules and hematological parameters.

Cases who worked as radiology technicians in our clinic and who had thyroid ultrasonography performed in the last 6 months were included in the study. Cases with a professional working period of less than 10 years were divided into two groups as group 1 and those with 10 years or more in group 2. The relationship between the presence of thyroid nodules, thyroid function tests and professional working time in radiology technicians was statistically analyzed.

A total of 70 people with a mean age of 39.1±8.5 were included in the study. When we look at the duration of the study, it was seen that 19 patients were in group 1 (less than 10 years) and 51 patients were in group 2 (10 years and above). The median age of people in group 1 was 30 (26-47), and the median age of people in group 2 was 41 (20-54). 20% (14) of the cases were female and 80% (56) were male, and there was no significant difference between the groups in terms of gender (p= 0.893). 10.5% of the cases in group 1 and 49% of cases in group 2 were found to have thyroid nodules, and this difference was statistically significant between the groups (p= 0.003). T3, T4 and TSH levels did not differ statistically between the groups.

It has been observed that there is a correlation between the duration of professional work in radiology technicians and the incidence of thyroid nodules, and we suggest that the sensitivity of radiation protection and preventive measures should be increased in the relevant units, importance should be given to training on the subject, and routine diagnostic follow-ups should not be interrupted.

**Keywords:** Thyroid Nodules, Radiation, Radiology Technician

## Introduction

Thyroid gland nodules are widely seen and generally benign entities. However, diagnosis, treatment, and follow-up are important in order to exclude thyroid cancer. The prevalence of nodular thyroid disease varies, depending on the population studied and the methods employed to detect nodules. Nodule incidence increases with age, and is higher in women, in individuals with iodine deficiency, and after exposure to radiation. Ultrasonography is an accurate, relatively more economical, and sensitive technique for thyroid nodule detection (1,2). The prevalence of iodine deficiency, the basic risk factor for thyroid nodule development, varies due to geographical differences. Other factors include smoking habits, family history of thyroid disease, environmental agents (such as nutritional habits), female gender, and older age (3,4). Our knowledge of thyroid neoplasms caused by radiation derives from studies of children exposed to head and neck radiation, largely for benign disease, and from studies of individuals exposed following atomic bomb explosion and the Chernobyl nuclear reactor incident (3,5,6). Several studies have

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shown that ionizing radiation is involved in changes occurring in the thyroid gland, particularly affecting the development of thyroid nodule and cancer[7]. Exposure to acute radiation has been shown to be more harmful than chronic exposure in these pathologies. There is no definite evidence linking thyroid nodule and cancer development with exposure to occupational radiation. However, some previous studies have suggested an increased development of thyroid nodule and cancer among workers exposed to occupational radiation, while others have postulated that it is difficult to regard radiation as a cause of nodule and non-malignant pathology (8). In this study, we evaluated the relationship between professional working time, thyroid nodule development and thyroid functions in radiology technicians working in our clinic.

## Material and Methods

Persons working as radiology technicians in our clinic and who had undergone thyroid ultrasonography in the last six months were included in the study. The institutional ethics review board approved the study with reference number of 2018/4-23 at the date of 22/05/2018. Thyroid ultrasonography results of the cases were evaluated retrospectively from hospital records. The cases were divided into two groups as Group 1 with professional experience of less than 10 years and Group 2 with experience of 10 years or more. Presence of thyroid nodules, gland sizes, gland parenchyma presence, relations between groups in terms of thyroid function tests, echogenicity and length of professional experience were subjected to statistical analysis.

**Statistical Analysis**: Analyses were performed on SPSS 21.0 software (IBM Corp. NY, USA). Continuity data conformity to normal distribution was determined by Kolmogorov Smirnov test. Non-normally distributed data were analyzed by Mann-Whitney U test. Pearson Chi-Square test was used to determine the relationships between qualitative data. Categorical data were expressed as frequencies (n) and percentages (%), and non-parametric data as median (minimum – maximum). A $p$ value of $<0.05$ was regarded as statistically significant.

## Results

A total of 70 people with a mean age of 39.1±8.5 were included in the study. When we look at the duration of the study, it was seen that 19 patients were in group 1 (less than 10 years), 51 patients were in group 2 (10 years and above). The median age of people in group 1 was 30 (26-47) and 41 (20-54) in group 2, and there was a statistically significant difference between the two groups (p= 0.001). 20% of the cases were female and there was no significant difference between the groups in terms of gender (p= 0.893). 10.5% of the cases in group 1 and 49% of cases in group 2 were found to have thyroid nodules, and this difference was statistically significant between the groups (p= 0.003). The median T3 level was 3.57 (3.02-5.48) in group 1 and 3.66 (2.60-4.88) in group 2 (p= 0.283). The median T4 level was 0.88 (0.68-0.98) in group 1 and 0.86 (0.55-1.05) in group 2 (p= 0.776). The median TSH level was 1.94 (0.71-4.59) in group 1 and 1.52 (0.50-9.50) in group 2 (p= 0.288) (Table 1).

When the cases with and without a thyroid nodule were compared, it was seen that the age of the people with the nodule was significantly higher (p= 0.004). The median working time was 8 (8-30) in those with nodules and 11 (4-27) in those who did not have a nodule, and there was a significant difference between the groups (p= 0.001). There was no statistical difference in terms of gender in patients with and without nodules (p= 0.713). There was no significant difference in terms of thyroid function tests in individuals with and without nodules (Table 2).

## Discussion

Exposure to radiation and complications that can develop as a result represent an important issue in terms of worker health. Thyroid nodules constitute an endpoint associated with the risk of thyroid cancer, and the prevalence of thyroid nodules therefore needs to be determined. Studies have reported differing conclusions regarding the association between thyroid nodule development and exposure to radiation.

In most studies, it has been observed that the frequency of thyroid malignancies is higher in workers exposed to radiation than in the general population; this is assumed to be due to over diagnosis due to regular thyroid screening in workers (9). A study in Belarus evaluated the radiation-related risks of various types of thyroid nodules among childhood exposure to Chernobyl fallout. The highest radiation risks were observed for neoplastic nodules, regardless of size, followed by large non-neoplastic nodules. In all nodule groups, the risk was highest in children exposed to radiation in infancy (10).

**Table 1.** Age, duration of employment, presence of nodules and distribution of thyroid function tests according to categorical data

| Variable | Group 1(n:19) | Group 2 (n:51) | p |
|---|---|---|---|
| | Median (Min-Max) | Median (Min-Max) | |
| Age | 30 (26-47) | 41 (20-54) | 0.001 u |
| T3 | 3.57 (3.02-5.48) | 3.66 (2.60-4.88) | 0.283 u |
| T4 | 0.88 (0.68-0.98) | 0.86 (0.55-1.05) | 0.776 u |
| TSH | 1.94 (0.71-4.59) | 1.52 (0.50-9.50) | 0.288 u |
| | n(%) | n(%) | |
| Gender | | | |
| Female | 4 (21.1%) | 10 (19.6%) | 0.893 p |
| Male | 15 (78.9%) | 41 (80.4%) | |
| Nodule presence | | | |
| Yes | 2 (10.5%) | 25 (49%) | 0.003 p |
| No | 17 (89.5%) | 26 (51%) | |

u Mann-Whitney U test, p Pearson Chi- Square Test, Min: Minimum, Max: Maximum

**Table 2.** The relationship between nodule presence, age, working time and thyroid function tests

| | Nodule presence n:27) | Nodule non-presence (n:43) | p |
|---|---|---|---|
| | Median (Min-Max) | Median (Min-Max) | |
| Age | 44(20-52) | 36(26-54) | 0.004 u |
| Duration of employment | 18(8-30) | 11(4-27) | 0.001 p |
| T3 | 3.6 (2.6-4.2) | 3.67 (2.78-5.48) | 0.562 u |
| T4 | 0.86 (0.55-1.05) | 0.87 (0.62-1.01) | 0.717 u |
| TSH | 1.5 (0.61-5.03) | 1.76 (0.5-9.5) | 0.412 u |
| | n(%) | n(%) | |
| Male sex | 21 (77.8%) | 35 (81.4%) | 0.713 p |

**u** Mann-Whitney U test **p** Pearson Chi- Square Test, Min: Minimum, Max: Maximum

Rizza et al. reported that the more thyroid nodules were detected in the night shift workers at the hospital than in the daytime workers (11).

In a study conducted in Italy, the prevalence of thyroid disease was found to be higher in healthcare workers exposed to mild ionizing radiation than in the control group. In particular, the prevalence of thyroid nodules in healthcare workers exposed to radiation was approximately twice as high as in the control group (12).

Adibi et al. reported that the prevalence of thyroid nodules among radiology department personnel exposed to radiation was not significantly higher than that among the general, unexposed population (8).

Age is known to be an important factor in thyroid nodule development, and the prevalence of nodules increases with age in both men and women (13,14,15). At the same time, Elzaki et al. reported that nodules were significantly more frequently among workers with11-15 years' occupational experience (13).

Many studies show that childhood radiation exposure is a risk factor for the development of thyroid malignancy. However, there is limited evidence to show whether early detection of thyroid malignancy improves survival rates and quality of life in these patients. Thyroid nodule screening is important in the long-term follow-up of thyroid dysfunction, thyroid malignancy, and childhood cancer survivors after radiotherapy (14).

In another study conducted in China, thyroid hormone dysfunction and thyroid nodules due to thyroid damage may be seen in workers exposed to low-dose radiation for a long time. In the late stage, it can turn into thyroid cancer (15).

In a study from 2003, Francesco et al. reported that health workers exposed to a moderate level of radiation were not at an extreme risk of thyroid nodules (16).

The present study determined a statistically significant association between length of work experience among radiology technicians and presence of nodules, which we attribute to exposure to occupational radiation.

The prevalence of nodules increased with age in the present study. However, work experience will also increase with age, and the fact that no differentiation was performed between these two factors represents the principal limitation of this study. Another limitation is that a control group was not employed. We therefore think that further multi-center and control-compared studies for the establishment of a larger research population may yield more meaningful results.

In conclusion, the prevalence of thyroid nodules among radiology technicians in the present study was associated with length of professional experience. We recommend that awareness of preventive and precautionary measures against radiation while working in relevant units be enhanced, that importance be attached to education on the subject, and that routine diagnostic checks should not be interrupted.

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