Research Article
Volume 6:1, 2022

Reports in Thyroid Research

ISSN: 2684-4273 Open Access

Relation between Occupational Exposure to Radiation and Thyroid Disorder among Technicians in Radiology Departments at Some Public Hospitals, Eastern Province, KSA

Alkhonaizi Rasha* **and Al-aloy yosra**

Abstract

To investigated whether radiological technician routinely exposed to ionizing relation have a higher prevalence of thyroid disorder, however the correlation between occupational radiation expose in hospital and thyroid disorder is not recognized. Method the cases in the study were technician who worked in public hospitals in eastern are (governmental only) the 309 cases were enrolled for the study, all participates were submitted self-answered questionnaire.

Keywords: Thyroid disorder • Radiation • Thyroid gland • Genetic material

Introduction

Many studies have indicated the effects of ionizing radiation on the thyroid gland especially as a prime cause of thyroid disorders. Radiation is the energy emission or transmission in the form of waves or particles which can penetrate substance and human being. Radiation is divided into two groups as Ionizing Radiation and Non-Ionizing Radiation according to its effects on the substance. Ionizing radiations cause ionization by breaking apart an electron from an atom or molecule. X and g-rays are the electromagnetic radiations composed of high-energy photons with ionizing capability. High energy ionizing electromagnetic waves can cause molecular changes which can lead to damage in biological tissue containing DNA and genetic material. It has also been accepted by the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) that X and gamma rays carry a risk of cancer for people. Professionals who work in an occupation involving radiological procedures can be at risk for exceeding annual radiation dose limits and the resulting long-term adverse health effects it causes. Several biological effects can result from ionizing radiation. These can be due to direct or indirect mechanisms and they can be acute or delayed. Acute effects occur with exposure to high-level radiation [1]. Delayed effects may appear after a long time and include cancer, genetic effects, effects on the unborn child, and other effects such as cataracts and hypothyroidism. Radiation effect on thyroid shown that damage to the follicular epithelium, extrusion of stored colloid, and an inflammatory infiltrate, which initially is neutrophilic and then becomes mixed before becoming chronic are seen. Then next stage will be there is stromal edema, but no significant fibrosis at this stage, fibrosis and follicular atrophy are the main changes seen after months and/or years of exposure of the thyroid to external radiation. The fibrosis is most prominent in the inter-lobular areas although perifollicular or trans-lobular fibrosis may also be seen. Scattered chronic inflammatory cells are noted within the areas of fibrosis; mild to moderate atypia of stromal fibroblasts and endothelial cells may accompany the fibrosis. The follicular epithelial cells can show a range of changes including random nuclear enlargement and hyperchromasia; metaplasia including oncocytic and squamous types; and the colloid can be shrunken and eosinophilic. In some cases, and this is probably dose dependent, the follicles themselves are small and atrophic. The other reported changes in thyroid gland after irradiation include chronic lymphocytic thyroiditis and multinodular goiter Depending upon the degree of fibrosis and the extent of follicular atrophy there may be thyroid dysfunction with the development of subclinical or overt hypothyroidism [2]. This clinical result in general is dependent upon the dose of radiation administered, the size of the gland prior to being radiated, whether or not there was nodularity to the gland before radiation, whether there was iodine deficiency in the patient and the time course over which the radiation occurred the technicians ,nurses, physicians, and others involved with nuclear medicine constitute the largest group of workers occupationally exposed to man-made radiation sources radiation areas are exposed as risky areas in terms of occupational health and safety. However, overexposure to radiation and the resulting adverse effects might be

Department of Radiology, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia

***Address to Correspondence:** Alkhonaizi Rasha Department of Radiology, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia, E-mail: rasha.shaker@hotmail.com*

Received: 29 December, 2021, Manuscript No. M- RTR-21-50850; **Editor assigned**: 31 December, 2021, PreQC No. P-50850; **Reviewed**: 14 January, 2022, QC No. Q-50850; **Revised:** 28 February, 2022, Manuscript No. R-50850; **Published:** 8 March, 2022, DOI: 10.37421/RTR.2022.6.16.

avoided with proper radiation protection, increased radiation knowledge, and adherence to safety practices based on previous studying (2017) called Radiation exposure and thyroid cancer: a review. The association between radiation exposure and therefore the prevalence of thyroid cancer has been well documented, and therefore the 2 main risk factors for the event of a thyroid cancer area unit the radiation dose delivered to the endocrine gland and therefore the age at exposure. The chance will increase when exposure to a mean dose of quite zero.05-0.1 Gy (50-100 mGy). The chance is a lot of vital throughout childhood and reduces with inflated age at exposure, being low in adults [3]. When exposure, the minimum latency stage before the looks of thyroid cancers is five to ten years. Process Cancer (PTC) is that the most frequent variety of thyroid cancer diagnosed when radiation exposure, with a better prevalence of the solid subtype in young youngsters with a brief latency stage and of the classical subtype in cases with an extended latency stage when exposure. Molecular alterations, as well as intra chromosomal rearrangements, area unit often found. Among them, RET/PTC rearrangements area unit the foremost frequent. Current analysis is directed on the mechanism of genetic alterations iatrogenic by radiation and on a molecular signature which will establish the origin of thyroid cancer when a known or suspected exposure to radiation another study called Occupational Exposure to Ionizing Radiation Is Associated with Autoimmune Thyroid Disease in 2005 study. The endocrine gland could be a potential organ for radiation related harm. The aim of the analysis was to research the association between activity exposure to radiation and reaction thyroid illness (AITD) [4]. The look was the cross-sectional study of health in Pomerania. The setting was the overall community. Analyses were performed in a very population-based sample of 4299 subjects. Among them, one hundred sixty persons according a history of activity exposure to radiation. AITD was outlined because the combined presence of hypo echogenicity in thyroid ultrasound and antithyroxiper enzyme antibodies bigger than two hundred IU/ml the Results were Females with activity exposure to radiation had a lot of usually AITD than non-exposed females (10.0 *vs.* 3.4%; P 0.05). This association persisted once adjustment for relevant confounders (odds quantitative relation, 3.46; ninety fifth confidence interval, 1.16–10.31; P 0.05). In males, there have been too few subjects UN agency consummated the factors of AITD, however the association between the exposure to radiation and hypo echogenicity of the endocrine gland barely lost applied math significance (odds quantitative relation, 2.20; ninety fifth confidence interval, 0.92–5.26; P 0.08). In each females and males, subjects UN agency according a length of exposure of over five periods exhibited the very best risk of the endpoints [5]. The analysis concludes that activity exposure to radiation is expounded to the chance of AITD. The usage of thyroid protection shields by radiation staff is powerfully counseled. Another study called Thyroid cancer and employment as a radiologic technologist published at 2006 suggest evidence of a potential occupational etiology of thyroid cancer among subgroups of radiologic technologists who appear to have higher radiation exposures another study. Another relationship between occupational radiation exposure and thyroid nodules considering that thyroid nodules and thyroid cancer occur a lot of oft in folks inveterately exposed to radiation, the aim of this study was to gauge the prevalence of thyroid nodules in an exceedingly population occupationally exposed to radiation in hospitals of Isfahan, Iran. During this case-control study, the prevalence of thyroid nodules in employees' members occupationally exposed to radiation made up our minds by sonography [6]. The results were compared with the results of another study among the adult population of Isfahan that designated by cluster sampling technique the two studied teams were matched in keeping with sex and age. The case and management teams enclosed 124 and 471 persons, severally. The prevalence of thyroid nodules within the case and management teams was twenty-two.6% and 24.6%, severally (p>0.05) though thyroid nodules were considerably a lot of rife in females within the management cluster, no such distinction was determined between females and males of the case cluster (p>0.05) the quantity of thyroid nodules (single or multiple) and calcification weren't completely different between the 2 teams (p>0.05). Additionally, hypo echogenicity of thyroid nodules wasn't completely different between the 2 teams for (p> 0.05) [7]. During this study, there wasn't any correlation between chronic activity exposure to low dose of radiation and also the risk of developing thyroid nodules. Additional studies with larger sample sizes, at completely different doses of radiation, and considering iodine standing and thyroid operate square measure so needed the objectives of this research to assess radiology dose. Exposure in hospital, to assess the thyroid disorder specific (hyperthyroidism/hypothyroidism), to assess potential factors associated with radiology dose exposed in hospitals (e.g. family history of thyroid disorder, years of work, amount of exposure, etc.) and Evaluate the relation between radiology dose and thyroid disorder.

Materials and Methods

Across sectional study was done in radiology departments in 5 governmental public hospitals (maternity and children hospital, Dammam medical tower, qateif central hospital, Dhahran general hospital and Jubail general hospital) in eastern area , KSA from march 2018 to February 2019 Data were collected Convenience sampling With exclusion criteria of technicians works less than one year by self-administered questionnaire valid by with the consent of the ministry of health answered by radiology technicians questionnaire includes items on demographics, work history, work practices, radiation exposure by personal medical examination, health-related behaviors and medical history. Hospitals were visited 4 days per week in eight consecutive weeks. The sample size was calculated using epi info, assuming (43.6%) based on the last study found in Saudi Arabia prevalence of thyroids dysfunction among Saudi Adult males and females from (June–September 2016) with accepted margin of error 5% sample by population survey will be=378 at 95% confidence level. 10 questioners were demonstrated as a pilot study among medical radiation technician. The Returned responses are 309/378 (81.7%), however, eight responses were excluded because they were not valid for analysis, so the valid responses for analysis were 301 responses (134 male, 167 female). All analysis was conducted using SPSS, version 23, setting our confidence level at 95%. Data collected about demographic characteristics for cases, and exposures with respect to their occupational duties and other possible risk factors for thyroid disorder, including work years in radiology department, familial history of thyroid disorders, exposure hours daily, and work days weekly. Descriptive Statistics by frequency and percent were used for categorical variables, Numeric data for continuous outcome variables was assessed for normality, if normal we used maximum, minimum, mean and SD [8]. *Chi square test* was used to assess the association between thyroid disorder (yes or no) and treatment (medication/

chemotherapy/ radiation/surgical) as well as the association between thyroid disorder and family history (yes/no) and between thyroid disorder and gender (male/female) and t-test was used to assess relation between thyroid disorder and number of exposure hours and t-test for thyroid disorder and number of exposure of hours and thyroid disorder with age logistic regression analysis was applied to find out the association between thyroid disorder as a dependent variable and number of exposure hours age, gender, family history and experience years. Adjusted odd ratio with corresponding 95%confidence intervals will be presented (Table 1).

Results

Descriptive statistics

Variables		descriptive	Categories	Count	N%
Age		-	20-30 years	78	0.259
		-	31-40 years	166	0.551
		-	more than 40 years	57	0.19
Gender		-	Male	134	0.445
		-	female	167	0.555
Work years	Minimum	1	1-5 years	94	0.312
	Maximum	33	6-10 years	124	0.412
	Mean	8.732	11-15 years	50	0.166
	Sta. D.	5.46	16-20 years	21	0.07
	Median	2	more than 20 years	12	0.04
	Total		301	1	
Exposure hours daily	Minimum	3	3 hours	1	0.003
			5 hours	4	0.013
	Maximum	10	6 hours	1	0.003
	Mean	8.37	8 hours	211	0.701
	Sta. D.	0.91	9 hours	37	0.123
	Median	8	10 hours	47	0.156
	Total		301	1	
Work days weekly	Minimum	3	3 days	6	0.02
	Maximum	6	4 days	2	0.007
	Mean	4.97	5 days	289	0.96
	Sta. D.	0.31	6 days	4	0.013
	Median	5	Total	301	1
Thyroid disorders		No	291	0.967	
		Yes	10	0.03	
Doing pre-employment examination		No	17	0.06	
		Yes	284	0.94	
Pre-employment examination result		negative	297	0.99	
		positive	4	0.01	
Family history of thyroid disorder		No	235	0.78	
		Yes	66	0.22	
hold (TLD) dosimeter badges		No	90	0.299	
		Yes	211	0.7	
suspend the work because of (TLD)dose above limits	No		286	0.95	
		Yes	15	0.05	

Table 1. Descriptive statistics showed the sample comprised of 301 Health care workers, 55.5% female, 44.5% male, their age divided into three age groups 20-30, 31-40, and greater than 40 year, The percentage was 26%, 55% and 19%, respectively.

The percentage of cases with thyroid disorders was 3.3% (10 cases), while the percentage of normal cases reached 97% (291 cases).The number of cases that made pre-employment examination was 284 cases, while only 17 cases did not make pre-employment examination. However, 2.7% (8 cases). Who have thyroid disorders are those who did the pre-employment test, only 0.6% (2 cases) are those who did not perform the pre-employment examination. Cases that have a family history with thyroid disorders are 22% (66 cases),of which 1.3% (4 cases) are those who have strikes thyroid.

Average of years' work for the cases studied was 8.7 years, and average daily hours of exposure to radiation was 8.3 hours per day, the cases are exposure to radiation less than 8 hours daily have not thyroid disorders, while the cases they have thyroid disorders are exposure to radiation 8 hours daily or more, thyroid disorders increase if the exposure to radiation's increasing more the average. Days working weekly range from 3 to 6 days. The most cases that have thyroid disorders are working for 5 days per week 2.3% (7 cases) (Figure 1).

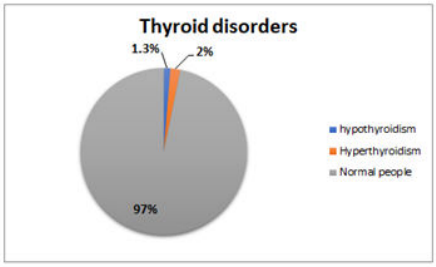

Figure 1. The figure shows the distribution of the sample, there is 3.3% (10 cases) have thyroid disorders, according to the type of thyroid disorders there is 2% (6 cases) have hyperthyroidism, and 1.3% (4 cases) have hypothyroidism. The Treatment which used by all cases of thyroid disorders (10 cases) is the medication and no one uses chemotherapy or radiation or other.

Crosstabs tests:

We used the Crosstabs test to classify study variables according to thyroid disorder and the type of thyroid disorder (Hyperthyroidism, hypothyroidism) as shown in Table 2.

Variables	Categories		Thyroid disorders	Total	*Chi-Square Tests*			
			nothing		Hyperthyroidism	hypothyroidism	Pearson *Chi-Square*	Exact Sig. (1-sided)
Gender	Male	Count	132	1	1	134	2.585	0.275
		%	0.439	0.003	0.003	0.45		
	female	Count	159	5	3	167		
		%	0.528	0.017	0.01	0.56		
Age	20-30	Count	75	2	1	78	2.91	0.573
		%	0.249	0.007	0.003	0.26		
	31-40	Count	162	3	1	166		
		%	0.538	0.01	0.003	0.55		
	more than 40	Count	54	1	2	57		
		%	0.179	0.003	0.007	0.19		
Doing pre-employment examination	No	Count	15	1	1	17	4.311	0.116
		%	0.05	0.003	0.003	0.056		
	Yes	Count	276	5	3	284		
		%	0.917	0.017	0.01	0.944		
Pre-employment examination result	negative	Count	291	4	4	299	98.991	0
		%	0.967	0.013	0.013	0.993		
	positive	Count	-	2	-	2		
		%	0	0.007	0	0.007		
Family history of thyroid disorder	No	Count	229	4	2	235	2.363	0.307
		%	0.761	0.013	0.007	0.781		
	Yes	Count	62	2	2	66		
		%	0.206	0.007	0.007	0.219		
Work years	Minimum				1	F=2.219, P=. 052		
	Maximum			33				
	Mean			8.732				
	Sta. D.			5.46				
Exposure hours daily	Minimum				3	F=2.524 P=.041		
	Maximum			10				
	Mean			8.37				
	Sta. D.			0.91				
Work days weekly	Minimum				3	F=11.472; P=. 000		
	Maximum			6				
	Mean			4.97				
	Sta. D.			0.31				

Table 2. Thyroid disorders type Crosstab.

Table 2 showed there are 5 cases (1.7%) of females have hyperthyroidism, and 3 cases have hypothyroidism, the Females have thyroid disorders more than males who have only two cases, the first is hyperthyroidism, and the second is hypothyroidism, In the two last columns we see the Pearson *Chi-square* value's (2.585) and its significant (sig.=.275), it's more than 5%, this means no relation between the thyroid disorder type and gender (there is no correlation between variables. In the age variable the group (31-40 years) there

are 3 cases (1.8%) have hyperthyroidism, and 1 case have hypothyroidism, the other age groups were different in the type of disorders in the lower age group (20-30 years) there are two cases have hyperthyroidism and one case with hypothyroidism, And the opposite in the other group, the significant of Pearson Chi-square value's (2.91) and its significant (sig=573), it's more than 5%, this means no relation between thyroid disorder type and age (there is no correlation between variables. In cases whose didn't make pre-employment examination there is 0.3% (1 case) have hypothyroidism, and 0.3% (1 case) have Hyperthyroidism, While the cases that made pre-employment examination there are 8 cases have thyroid disorder, Pearson *Chi-square* value's (4.311) and its significant (sig=116), it's more than 5%, this means no relation between thyroid disorder type and pre-employment examination (there is no correlation between variables. When we look at the pre-employment examination result, we find 0.7% (2 cases) that have positive result, they are have hyperthyroidism, Pearson *Chi-square* value's (98.991) and its significant (sig.=.000), it's less than 5%, this means no independence between thyroid disorder type and pre-employment examination result (there is a correlation between variables. In cases that don't have family history with thyroid disorder there are 1.3% (4 cases) have hyperthyroidism, and 2 cases have Hypothyroidism, while 4 cases whose have family history , they are have thyroid disorder, Pearson *Chi-square* value's (2.363) and its significant (sig.=.307), it's more than 5%, this means no correlation between thyroid disorder type and family history with thyroid disorder. The results of the ANOVA test for the variable work years shown test value is (F=2.219) and the significance (sig=0.052) it is greater than 0.05., this means that there were no statistically significant differences between cases with thyroid disorders in terms of years of work years. In the variable of exposure daily hours to radiation, the results are shown the ANOVA test value is (F=2.524) and the significance (sig=0.041) it is less than 0.05. So there are statistically significant differences between cases with thyroid disorders in terms of exposure daily hours to radiation. In the variable of work days weekly, the results are shown the ANOVA test value is (F=11.472) and the significance (sig=0.000) it is less than 0.05., So there are statistically significant differences between cases with thyroid disorders in terms of work days weekly.

Logistic regression analysis

Logistic regression analysis was applied to determine whether thyroid disorder as a dependent variable is influenced by the independent variables that are: age, gender, work years, pre-employment examination, disorders history, exposure hours daily, and workdays weekly (Table 3).

Variables		B	S.E.	Wald	df	Sig.	Exp (B)
Step 1a	Age	0.059	0.675	0.008	1	0.93	1.061
	Gender	0.801	0.986	0.66	1	0.417	2.228
	Work years	0.004	0.096	0.002	1	0.965	1.004
	Pre-Examination	-.889-	1.03	0.746	1	0.388	0.411
	Family Disorders History	0.151	0.764	0.039	1	0.843	1.163
	Exposure hours daily	1.39	0.484	8.237	1	0.004	4.016
	Work days weekly	-2.070-	0.612	11.434	1	0.001	0.126
	Constant	-6.417-	4.205	2.329	1	0.127	0.002

a. Variable(s) entered on step 1: Age, Gender, Work years, Pre-Examination, Disorders History, Exposure hours daily, Work days weekly.

Table 3. Variables in the Equation of logistic regression.

Table (3) shows the results of the test with 95% confidence there are two independent variables (daily hours of exposure to radiation and the weekly workdays) that effect on the dependent variable (thyroid disorders), sig. 0.004, 0.001respectively, a regression coefficient of 0.902. This means that the higher the exposure time increases the possibility of thyroid disorders, while the other independent variables (Age, Gender, Work years, Pre-Examination, family disorders History) don't affect the dependent variable, because the significantly is more than 5% for each. In the column of confidence shows the largest value of exponential of Beta Exp(B)=4.016 in the exposure hours daily variable this means that's the more hours of exposure to radiation at the rate of one hour per day, this increases the risk of thyroid and disorders more than 4 times, The same analysis applies to other independent variables.

Discussion

Our study results showed a significance correlation between thyroid disorders and the exposure to radiation hours daily, in Table 2 significance is (0.043) it is less than 0.05 this means that the relationship is statistically significant, While, there is no related between thyroid disorder and age, gender (male/female), and family history. This result was agreed with did not agree with our research, there wasn't any correlation between chronic activity exposure to low dose of radiation and also the risk of developing thyroid nodules. Additional studies with larger sample sizes, at completely different doses of radiation, and considering iodine standing and thyroid operate square measure so needed.

Conclusion

This study concludes that There are no thyroid disorders in cases exposed to radiation of 3, 5,6 hours a daily, but thyroid disorder increases from 3 cases at 8 hours of exposure to radiation to 5 cases at 10 hours of exposure. Number of cases exposed to radiation at a rate of 8 hours is 208, while the number of cases exposed to radiation for 10 hours is 42, but cases they have thyroid disorders are the most vulnerable to rate radiation 10 hours, In our study there were no statistically significant differences between cases with

thyroid disorders in terms of work years (which mean we can't assume exactly every Pearson work in the hospital in each year exposed to exact amount of radiation there is a huge different between each person) considering the TLD card which most of the health workers don't use it based on the result in our study (29.9%) were not using it according to our study meanwhile IN Kim, KH, Woo, SH. The main limitation of the study is the absence of accurate individual estimates of radiation dose. Individual measurements, however, have so far not been adequately computerized and available for epidemiologic analyses. A subsequent study is required to individually measure radiation exposure in a hospital and there is a need for prospective cohort study for determining relationship between radiation and thyroid cancer. In conclusion in that study, although there are many other parameters that should be taken into account, the result showed that working in a hospital does not increase the prevalence of thyroid nodules or thyroid cancer.

Recommendations

In future studies, research should be done with large sample groups. Make annual thyroid function test for all radiology department staff and depended it as baseline it is recommended to use TLD card in constant way encourage radiation department staff use thyroid protection shield. Specific thyroid function test during pre-employment examination for every person has been assigned to radiology department.

References

1. Adibi, Atoosa, Rezazade Afshin, Hovsepian Silva, and Razie Koohi, et al. "The Relationship between Occupational Radiation Exposure and Thyroid Nodules." *J Res Med Sci* 17 (2012): 434.
2. Iglesias, Maria Laura, Schmidt Angelica, Al Ghuzlan Abir, and Lacroix Ludovic, et al. "Radiation Exposure and Thyroid Cancer: A Review." *Arch Endocrinol Metab* 61 (2017): 180-187.
3. Kim, Kyung Hee, and Hoon Woo Seung. "An Occupational Study in Nurses: Prevalence of Thyroid Nodules and Cancer in Comparison to Health Check-Up Female." *Clin Exp Otorhinolaryngol* 9 (2016): 252.
4. Ko, Seulki, Hoon Chung Hwan, Bum Cho Sung, and Woo Jin Young, et al. "Occupational Radiation Exposure and its Health Effects on Interventional Medical Workers: Study Protocol for a Prospective Cohort Study." *BMJ Open* 7 (2017): e018333.
5. Neta, Gila, Rajaraman Preetha, Gonzalez Amy Berrington de, and M Doody Michele, et al. "A Prospective Study of Medical Diagnostic Radiography and Risk of Thyroid Cancer." *Ame J Epidemiol* 177 (2013): 800-809.
6. Sinnott, Bridget, Ron Elaine, and Schneider Arthur B. "Exposing the Thyroid to Radiation: a Review of its Current Extent, Risks, and Implications." *Endocrine Rev* 31 (2010): 756-773.
7. Völzke, Henry, Werner André, Wallaschofski Henri, and Friedrich Nele, et al. "Occupational exposure to ionizing radiation is associated with autoimmune thyroid disease." *J Clin Endocrinol Metab* 90 (2005): 4587-4592.
8. Zabel, Erik W, H Alexander Bruce, J Mongin Steven, and M Doody Michele, et al. "Thyroid Cancer and Employment as a Radiologic Technologist." *Int J Cancer* 119 (2006): 1940-1945.

How to cite this article: Rasha A, Yosra Al-aloy. "Relation between Occupational Exposure to Radiation and Thyroid Disorder among Technicians in Radiology Departments at Some Public Hospitals, Eastern Province, KSA." *Rep Thyroid Res* 6 (2022): 16.