The Assessment of I-131 Internal Doses of Nuclear Medicine Workers in Korea Using Thyroid uptake system

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1. Introduction

There are possibilities the radiation workers could intake the radiation when workers deal with radiation-materials. Therefore, internal radiation doses of radiation workers need to be assessed. Although an application of the nuclear medicine is continuously increased in Korea, there is not a proper tool and form to monitor the internal doses of nuclear medicine workers. However, it is possible to attain the internal doses of I-131 to evaluate using thyroid uptake and well count system [1,2].

In this study, we measured and evaluated the I-131 internal doses of nuclear medicine workers in Korea using thyroid uptake and well count system and performed an air sampling.

2. Materials and Methods

2.1 Subjects

Thyroid scans were performed for each week during a month to the nuclear medicine workers of 3 hospitals which are using I-131 in Korea. Forty Radiation workers who works in a gamma imaging, PET/CT imaging, cyclotron operation, in vitro, 131 therapy ward, thyroid imaging, radiopharmaceutical distribution ($99mTcO_4$-, I-131, F-18) were subjected.

2.2 Measuring Equipment and Method of Thyroid

Two thyroid uptake system, CAPTUS 3000 (CAPIN-TEC. Inc. U.S.A), were used as Measuring Equipments with 2 inch NaI (Tl) scintillation detector with Collimator [Fig. 1].

Each radiation worker was measured after 2 or 3 days on a week. First, a background count was measured on thigh in the distance of 25cm for a minute. Second, a thyroid count was measured in the distance of 25cm for a minute. An air sampling was measured for a minute and evaluated [3].

2.3 Air sampling or Measuring Method

HI-Q and DF-40L-8 from F&J, Air sampling machine, were installed on the height of 1.5m and measured for 60 minutes. Average air trapping rate was 40L/min using NAC-100L filter from NAC Company. The trapped samples were measured and evaluated with MCA System 10, high purity Germanium detector from CANBERA, and Genie-2000 software [4].

Fig. 1 Thyroid uptake and well count system (CAPTUS 3000 CAPINTEC. Inc. U.S.A)

3. Measurement Results

3.1 Thyroid Results

Maximum and minimum values of the thyroid and body background counts of I-131 dealing workers and non-dealing workers were compared. An average and standard deviation of the background of the room was calculated. There was no correlation between the background of the room and the body background. The reason assumed that an energy resolution and a stability was poor There were not a difference at the I-131 dealing workers and non-dealing workers [Table 1]. There is a possibility that even though the internal radiation exposure of I-131 was occur to the radiation workers, the working place and conditions of I-131 dealing workers and non-dealing workers are not far apart.

Table 1. Measurement Data for Thyroid and Body Background.(unit : cpm)

		Thyroid	Body Bkg	Room Bkg
Non ^{131}I	Max.	181	136	163.13±13.03
	Min.	146	247	
^{131}I	Max.	173	128	
	Min.	204	380	

3.2 Results of the Radiation Density in the Air

The radiation density in the air of a hospital A was analyzed and showed as a table and a graph[Table 2, Fig. 2]. 21,600mCi has been used for 2 month in radiopharmaceutical distribution room of hospital A. The maximum of 475.4 Bq/m^3 (average 37.6 Bq/m^3) of 131I was measured. Maximum of 79.7 Bq/m^3 (average 26.7 Bq/m^3) of 123I was measured.

On thyroid therapy ward, 14,250 mCi (capsule - 13,366 mCi, liquid - 884 mCi) of 131I was used, and the maximum of 133.0 Bq/m^3 (average 46.6 Bq/m^3) was measured. The maximum of 72.7 Bq/m^3 (average 13.3 Bq/m^3) was measured on an aisle.

Table 2. Analysis Result of Radioactivity Level in Air

		Radioactivity level(Bq/m^3)		
		distribution room		sickroom corridor
		Nuclear medicine	sickroom	
I -131	min	0.061	7.650	0.690
	max	**475.4**	**133.0**	**72.70**
	average	37.62	46.55	13.32
I -123	min	0.088	0.256	0.140
	max	**79.73**	0.633	3.120
	average	26.66	0.406	1.748
Tc -99m	min	0.726	ND	ND
	max	4.470	ND	ND
	average	2.598	ND	ND
F -18	min	0.003	ND	3.450
	max	0.368	ND	
	average	0.186	ND	

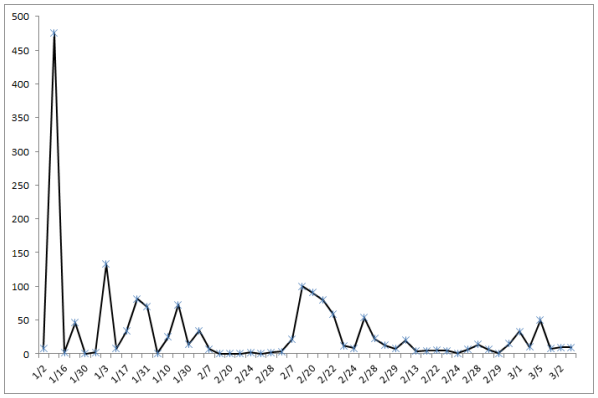

Fig. 2. Analysis tendency of radioactivity level in air

4. Conclusions

Using thyroid uptake and well count system, the I-131 internal doses of nuclear medicine workers were measured and evaluated, a difference in the radiation workers duties was not showed. However, the radiation density in the air using the high purity Germanium detector showed a statistical significance [Fig. 2.]. It was believed that thyroid analysis could be easily affected by external factors. The internal dose measurement seemed have a limitation. Therefore, more studies need to be done with an urine radiation measurement and air sampling.

In this study, thyroid analysis is only administrated to the radiation workers so that we believe more researches and studies should be performed in the long term.

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