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Analysis of Correlation Between Urinal Excretion Ratio of Radioactive Iodine & Daily Urinal Excretion Volume

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1. Introduction

Internal exposure to radionuclide results from depositing of radioactive substance within human body and is called intra-body exposure as well. Radioactive substance may find its way into human body via nose, mouth or skin and internal exposure to radionuclide is rarely ascribable to radioactive substance deposited through skin. Radioactive substances deposited in human tissues or organs do not stay there for good. Instead, they are transferred to other tissues, organs or excreted by sweat, excrements, urine and breath [1]. However, natural excretion has its limits in terms of safeguarding human body actively against radioactive exposure. When radionuclide is deposited in human organs or tissues, diuretic or evacuant is used to induce excrements or urine to increase removal and discharging of radionuclide artificially, thereby reducing internal exposure. [2] Therefore, we have attempted to propose an optimum approach to removing and excreting radioactive iodine by analyzing the correlation among the radioactive iodine intake ratio, daily urinal excretion ratio and volume.

2. Methods and Results

2.1 Blocking Radioactive Iodine

Injecting a large volume of stable nuclide can block the intake of radionuclide. Taking 130 ㎎ of potassium iodide per day for 2 weeks can prevent thyroidal accumulation of radioactive iodine. If potassium iodide is taken within several minutes from exposure, thyroidal accumulation can be blocked up to 90%. However, if the intake is delayed by 6 hours, radioactive iodine accumulation ratio drops to 50%. [2]

2. 2 Analyzing Daily Urinal Excretion Volume

According to early ICRP-23 (as of 1974), daily urinal excretion volume of adult male and female was 1400 ㎖ and 1000 ㎖ respectively. ICRP-89 (as of 2003) released later divided the value even further by gender and age group and identified daily urinal excretion volumes as illustrated in Table 1. According to ICRP-89, adults excrete from 1200 ㎖ to 2000 ㎖ per day and an adult male weighing 73-kg excretes approximately 1600 ㎖. In other words, ICRP-89 reported a daily urinal excretion volume of 22 ㎖/kg/day.[3,4]

[Table.1]. Reference values for daily urinary excretion

Age	Excretion(㎖/day)	
	Male	Female
Adult	1600	1200

2.3 Measuring Thyroidal Intake Ratio & Urinal Excretion Ratio of Radioactive Iodine

Thyroidal intake ratio, urinal excretion ratio of radioactive iodine and daily urinal excretion volume were measured for 28 Korean adult males. 24 hours after radioactive iodine intake, thyroidal intake ratio was 19.70%, urinal excretion ratio was 71.12% and daily urinal excretion volume was 1866.39 ㎖ on average.

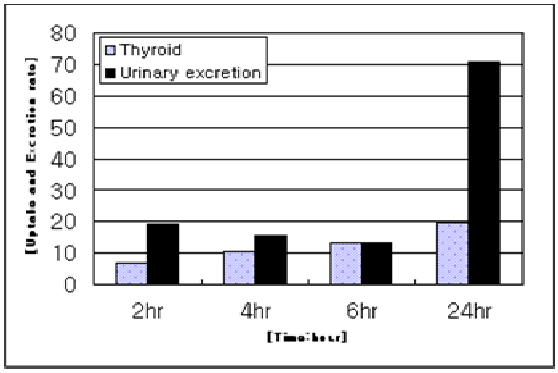

Fig.1 Uptake and excretion rate by time [Unit:%]

[Table. 2] Analysis of Daily Urinal Excretion Volume
[Unit: ㎖/day]

Mean(Standard Deviation)	median	mode
1866.39(632.49)	2017.5	2350 (2336)

In the analysis data, thyroidal intake ratio showed a gap with the existing ICRP data, but, urinal excretion ratio and daily excretion volume revealed similar tendencies. In reference to such measurement results, correlation among urinal excretion ratio and thyroidal intake ratio of radioactive iodine and daily excretion volume was analyzed as shown in Table 3. In the analysis, the coefficients among daily urinal excretion ratio, daily urinal excretion volume and thyroidal intake ratio of radioactive iodine were 0.1($p > .05$) and 0.0487($p > .05$) respectively, which did not indicate any statistical correlation. Therefore, it can be inferred that urinal excretion ratio of radioactive iodine is independent of daily urinal excretion volume.

[Table. 3] Analysis of Correlation between Urinal Excretion Ratio of Radioactive Iodine & Daily Urinal Excretion Volume

Parameter	Urinal Excretion (P-value)	Daily Urinal Excretion Volume (P-value)
Urinal Excretion		
Daily Urinal Excretion Volume	0.1003(0.692)	
Thyroid uptake	0.0487(0.848)	0.1066(0.674)

3. Conclusion

Assessment of internal radioactive exposure is highly critical in radioactivity protection. Radionuclide accumulates in different organs for each type of nuclide and dose of each organ also varies in accordance with physiological characteristics. To safeguard against radioactivity more actively, this paper attempted to analyze the correlation among thyroidal intake ratio, urinal excretion ratio and daily urinal excretion volume in relation to radioactive iodine. As a result, thyroidal intake ratio revealed a gap with existing ICRP data, but, urinal excretion ratio and daily urinal excretion volume showed similar tendencies. In addition, the analysis of correlation indicated that the urinal excretion ratio of radioactive iodine is independent of daily urinal excretion volume. Oral intake of drinkable water or injection of fluid in large volume is proposed as an approach to diluting radionuclide and inducing its urinal excretion to reduce radioactive internal exposure by soluble nuclide. However, judging from the results herein, more fundamental solution seems to be necessary rather than simply inducing urinal excretion in response to internal exposure to radionuclide.

Acknowledgement

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