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A study on radiation exposure dose of persons with frequent access within the radiation management area

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ABSTRACT : The purpose of this study was to provide basic data for optimizing radiation defense by measuring and analyzing the radiation exposure dose of radiology students who are engaged in clinical practice within the radiation management area. The study subjects measured the dose of 121 students who completed the hospital clinical practice for 8 weeks. The shallow dose was 0.15 ± 0.14 mSv, suggesting that 1.0 per 1,000,000 population had a probability of causing pulmonary side effects, and the deep dose was 0.14 ± 0.14 mSv, which resulted in a probability of 9.6 per 10,000,000 population.Therefore, in this study, the exposure dose was quantitatively analyzed by wearing a dosimeter during clinical practice in a university hospital. Furthermore, it is thought that it provided basic data for optimizing radiation protection by calculating the probability of causing side effects in the lungs.

KEYWORDS: Person with Frequent Access, Radiological technology, Exposure dose, Radiation dose

I. INTRODUCTION

Advances in medical equipment have a significant impact on early diagnosis of diseases. In particular, medical radiation equipment is an important essential element [1]. Nevertheless, because the benefit from radiation is great for the patient, it is insensitive to the resulting exposure dose. Among the biological effects of radiation, there is no threshold dose for stochastic effects [2]. Therefore, even if a small dose is continuously exposed to radiation, there is a high possibility of cancer and side effects [3]. In accordance with the recommendations of the ICRP, strict management of nuclear safety laws and medical laws is being implemented. Recently, as the radiation safety for frequent visitors to the radiation management area becomes more important, the radiation exposure dose management of clinical practice students is also being strengthened [4]. Therefore, in this study, the radiation exposure dose received by radiology students during clinical practice at the hospital was measured to provide basic data for radiation optimization.

II. MATERIAL AND METHODS:

A total of 121 radiology students receiving clinical practice in the radiation management area of University C Hospital for 8 weeks from January 2022 were targeted. These students accompany the departments of radiology, radiation oncology and nuclear medicine, as well as operating rooms, cardiovascular imaging rooms, and portable X-ray imaging. That is, general imaging, fluoroscopy, angiography, computed tomography, magnetic resonance imaging, and ultrasound examination are cycled for one week.As the dosimeter used in the experiment, an optically stimulated luminescence dosimeter was worn on the left chest.

III. RESULT

As shown in Table 1, the exposure dose of 121 radiology students who received clinical practice at the hospital for 8 weeks was calculated as a shallow dose of 0.15 ± 0.14 mSv. The deep dose was 0.14 ± 0.14 mSv, resulting in a probability of 9.6 per 10,000,000 population.. The Nominal risk factor used to calculate the cancer probability using the measured photoneutron dose is 5.7 % per Sv for the entire population. According to ICRP 103 [5], the lung tissue weighting factor was 0.12, which calculated the cancer probability.

= (accumulated radiation dose for 8 weeks: mSv) × (lung tissue weighting factor) × (nominal risk coefficient: 10^{-2}/ Sv) (1)

As a result, it can be seen that the cancer incidence rate due to radiation exposure of the colon and thyroid gland, which are normal organs, was 10.6 cases per 1,000 people, and there was a chance of developing cancer in 3.5 cases in VMAT when IMRT 9 portals were treated with radiation for prostate cancer.

FIGURES AND TABLES

Figure 1. Optically stimulated luminescence dosimeter used in the experiment

Figure 2. A dosimeter is worn on the left chest.

Table 1. Exposure dose of clinical practice students (unit: mSv)

Classification	Exposure dose	
Shallow dose	0.15±0.14	1.03×10^{-6} 1.0 per 1,000,000
Deep dose	0.14±0.14	9.58×10^{-7} 9.6 per 10,000,000

IV. DISCUSSION

According to the recommendation of the International Commission on Radiation Defense, the annual dose limit is fixed at 1 mSv for the general public under planned exposure situations. In the case of occupational exposure, the dose limit was set at an annual average of 20 mSv for 5 years within the range not exceeding the maximum of 50 mSv per year [5].Therefore, in hospitals using medical radiation equipment, exposure management is being strengthened within the radiation control area. The clinical practice students do not actually take part in the radiation examination and treatment of patients, but live in the radiation area for the duration of the training in a rotational work system.Therefore, in this study, the exposure dose was quantitatively analyzed by wearing a dosimeter and measuring it during clinical practice in a university hospital. Furthermore, the probability of causing side effects in the lungs was calculated and analyzed.

The dosimeter used for the measurement was widely used in a specific air range, and OSLD with proven stability due to chemical and mechanical properties was used. The results of this study are of great significance in that they suggest the need for more systematic management of the exposure management of clinical practice students rather than simply a reference level.When considering the risk of low-dose radiation based on the Linear no threshold model, the risk of cancer occurrence increases by 0.005% when exposed to 1 mSv. Of course, the 8-week clinical practice period is a short period, and it may be considered that the dose is insufficient. However, Ha argued that low-dose radiation could harm the human body based on the mutated expression of Glycophorin A [6].Internship students should pay attention to radiation exposure management, recognizing that the 8-week period is not the end, but starting soon as they are preliminary radiographers who are engaged in the field of radiation for a long time.
The limitation of this study is that it was not possible to target more students. However, it is considered to have

provided basic data for the management of the exposure dose of frequent visitors who are in the blind spot of radiation safety management.

V. CONCLUSIONS

The purpose of this study is to provide basic data for optimizing radiation defense by measuring and analyzing the radiation exposure dose of radiology students who are engaged in clinical practice within the radiation management area.The shallow dose was 0.15 ± 0.14 mSv, which suggested that 1.0 per 1,000,000 population had a probability of causing pulmonary side effects, and the deep dose 0.14 ± 0.14 mSv gave a probability of 9.6 per 10,000,000 population. As a result of analyzing the incidence of thyroid and colon cancer, it was found that 10.6 people per 1,000 people with IMRT and 3.5 people with VMAT had a secondary chance of getting cancer.This study will study the risk of secondary radiation exposure that may occur during radiation therapy, and will be used as basic data related to stochastic effects in the future.

REFERENCES

[1] YO Kim, YH Seong, Evaluation of Radiation Dose Reduction from the Automatic Exposure Control Technique in Different Manufactures Multi-Detector Computed Tomography, *Proceedings of the Safety Management and Science Conference*, 11a, 2011, 563-571

[2] CG Kim, Spatial dose distribution and exposure dose during lumbar lateral test, *Journal of the Korea Convergence Society*, 5(1), 2014, 17-22

[3] JA Lee , Evaluation of Cancer Incidence Rate using Exposure Dose to Surrounding Normal Organs during Radiation Therapy for Prostate Cancer, *Journal of the Korean Society of Radiology*, 16(3), 2022, 351-356

[4] BW Lee, CG Kim, A study on the convergence perception of students in radiology on the reorganization of safety management system by person with frequent access of nuclear safety act, *Journal of the Korea Convergence Society*, 10(6), 2019, 89-94

[5] ICRP Publication 103, The 2007 Recommendations of the International Commission on Radiological Protection, *ICRP Publication 103. Ann. ICRP 37, 2-4*, 2007

[6] MN Ha, Assessment of the Glycophorin a mutant assay as a biologic marker for low dose radiation exposure, Graduate school of Seoul National Univ, 2000