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Avera McKennan Hospital & University Health Center
Imaging Services
1325 S Cliff Ave
Sioux Falls, SD 57105

December 28th, 2020

Michelle White
Radiation Safety Officer
Avera McKennan Hospital & University Health Center
1325 S Cliff Ave
Sioux Falls, SD 57105

Dear Ms. White,

This letter is in response to your request for dose estimations for a patient who received an unintended dose of [131]I. Per your provided information, the patient was administered a dose of 15.8 mCi (585 MBq) ^{131}I-iodide. The effective dose, the maximum equivalent dose delivered to an organ, and the shallow dose equivalent were estimated from the activity administered to the patient.

The level of iodine uptake in the thyroid was unknown, however the thyroid stimulating hormone level of the patient suggests there may be an increased uptake due to hyperthyroidism. Thus, the dose estimates provided assume an elevated thyroid uptake in an average adult. It should be noted that these estimates will be higher than that of a typical adult.

The organ receiving the maximum dose from the administered radioactivity is the thyroid. It is estimated that the thyroid will receive a dose of 580 mGy/MBq [1], or 340 Gy for the total administered dose of 585 MBq. As the absorbed dose is due to beta and gamma radiation (both with a radiation weighting factor of 1), the estimated dose equivalent would be 340 Sv to the thyroid.

The effective dose equivalent is estimated to be 29 mSv/MBq [1] based on tissue weighting factors from ICRP Publication 60. For this particular radiopharmaceutical, the dose delivered to the thyroid is orders of magnitude greater than other organs, thus the effective dose equivalent estimation is dominated by the thyroid tissue weighting factor. The tissue weighting factor was notably decreased from 0.05 in ICRP Publication 60 to 0.04 in ICRP Publication 103 [2]. Thus a more current estimation of the effective dose equivalent is 23.2 mSv/MBq, or 13.6 Sv for the total administered dose of 585 MBq.

The shallow dose equivalent is estimated from the dose to the skin. The absorbed dose to the skin is approximately 0.071 mGy/MBq [1], or 42 mGy for the total administered dose of 585 MBq. This equates to a shallow dose equivalent of 42 mSv.

In summary, the estimated effective dose equivalent, maximum dose equivalent delivered to an organ, and the shallow dose equivalent for an average adult with increased thyroid uptake for an orally administered dose of 15.8 mCi ^{131}I-iodide are approximately:

Effective dose equivalent – 13.6 Sv
Dose equivalent to the thyroid – 340 Sv
Shallow dose equivalent – 42 mSv

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Avera McKennan Hospital & University Health Center

[1] ICRP, 2015. Radiation dose to patients from radiopharmaceuticals: a Compendium of Current Information Related to Frequently Used Substances. ICRP Publication 128. Ann. ICRP 44(2).

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