RADIOPROTECTION IMPACT OF RADIOIODINE THERAPY FOR HYPERTHYROIDISM AFTER A PATIENT SPECIFIC DOSIMETRIC STUDY

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BACKGROUND-AIM

In patients with hyperthyroidism, the treatment with $^{131}$I should rapidly obtain a nonhyperthyroid status. There is an ongoing discussion on the establishment of the method to determine the activity that can be recommended for clinical practice: estimation (the so-called "fixed dose") versus calculation (based on radioiodine uptake measurements), however the optimization principle states that a patient should be given the minimum activity necessary to obtain the clinical goal. In our Nuclear Medicine Department all hyperthyroid patients are submitted to a patient specific pretreatment study to calculate the minimum activity to administer in order to achieve euthyroidism, in the case of nodular autonomies, and hypothyroidism, in the case of Graves’ disease.

Aim: to retrospectively evaluate the radioprotection impact of outpatients radioiodine therapies for hyperthyroidism after patient specific dosimetric studies, with respect to the standard administration of 600 MBq (maximum activity allowed by Italian radiation protection law).

METHODS

470 patients were considered (161 Graves and 309 nodular autonomies, 344 F, median age = 66 y [range 17-89 y], mean iodine uptake=39%). They all reached a nonhyperthyroid status within 1 year from the administration.

RESULTS

The median $^{131}$I therapeutic orally administered activity was 392 MBq (10.6 mCi) with a range between 66 and 607 MBq (1.8-16.4 mCi). The total administered activity was 200 GBq (5.4 Ci). If the standard activity of 600 MBq had been administered to all patients the total activity would have been 282 GBq (7.6 Ci), an amount 41% greater than the really used one. This obviously acts also on the patient mean effective dose equivalent and on the mean absorbed dose to the stomach wall (critical organ for $^{131}$I iodide) (ICRP 53) that were 6 Sv instead of 9 Sv and 0.20 Gy instead of 0.28 Gy respectively, with a maximum of dose saving (8 times) for the patient who was given the minimum activity of 66 MBq.

The reduction of $^{131}$I administered activity also acts on the radiation exposure of the nuclear medicine unit staff and of population: the mean dose rate at 1 m at the dismissal time is 12 μSv/h instead of 20 μSv/h. This approach involves also the environment, as in the first 24 hours the 60% of the administered activity is excreted by the body.

CONCLUSION

The application of a patient specific pretreatment dosimetric study can reduce of more than 40% the radiation protection impact of radioiodine treatments of hyperthyroidism with optimal clinical results guaranteed.