Improved Planning of Radioiodine Therapy for Thyroid Cancer

TO THE EDITOR: In regard to the prolonged measurements and frequent data sampling performed after both diagnostic and therapeutic administration of radioiodine in thyroid cancer patients, the recent work of Hermanska et al. (*1*) has the potential of shedding more light on radiobiological effects of ^{131}I radiation. In their paper (*1*), the authors proposed an alternative to a monoexponential model of radioiodine kinetics to assess more accurately time–activity curves over thyroid remnants. The ratio of residence times (τ_d/τ_t) of diagnostic (70–75 MBq) versus therapeutic (4.2 ± 1.4 GBq) activity of ^{131}I found to be ≥1.5 (*1*).

Every time–activity curve is generally characterized by 3 parameters: the effective half-life of an uptake phase (T_U), the maximum uptake (U_{MAX}), and the effective half-life of a clearance phase (T_C). The latter parameters can be derived by fitting the time–activity curve, in order to calculate the residence time by curve integration. Apart from the obvious need of having appropriate measurements and kinetic modeling, the ultimate aim is to put forward practical guidelines for improved planning of radioiodine therapy, once diagnostic dosimetric parameters are determined. In context, it would be interesting to have more data from Hermanska et al. on (*i*) the correlation between diagnostic and therapeutic values of T_U, U_{MAX}, T_C, and τ, and between (τ_d/τ_t) and τ_d, τ_t (models, parameters, coefficients of correlation, probabilities) and (*ii*) the ratio of diagnostic over therapeutic values of T_U, U_{MAX}, and T_C (means, SDs, paired *t* tests). Our experience is that a shorter observed than predicted therapeutic residence time is, to a similar extent, the result of both decreased initial uptake and shorter effective clearance of therapeutic versus diagnostic activity, and that the impact of diagnostic dosimetric parameters is at least as important as of those therapeutic.

Early radiation damage of thyroid cells by therapeutic radioiodine is a plausible cause for different kinetics of diagnostic and therapeutic I, but this hypothesis and its prevalence remains to be quantitatively proved. Until then, the latest advances on the "diagnostic" side of the issue plead for <74 MBq (likely ≤37 MBq) of diagnostic I activity (*1–5*) and <10 Gy (likely ≤5 Gy) of diagnostic I absorbed dose in the target tissue (*2,4,5*) to avoid thyroid stunning before expected radioiodine therapy. Otherwise, appropriate models should be applied to take into account the extent of thyroid stunning.

REFERENCES

1. Hermanska J, Karny M, Zimak J, Jisra L, Samal M, Vlcek P. Improved prediction of therapeutic absorbed doses of radioiodine in the treatment of thyroid carcinoma. *J Nucl Med.* 2001;42:1084–1090.
2. Medvedec M, Grosev D, Loncaric S, Pavlinovic Z, Dodig D. Radiation absorbed dose makes the stunning overtakes [abstract]. *J Nucl Med.* 2000;41(suppl):239P.
3. Yeung HWD, Humm JL, Larson SM. Radioiodine uptake in thyroid remnants during therapy after tracer dosimetry. *J Nucl Med.* 2000;41:1082–1085.
4. Behr TM, Behe MP, Gratz S, Hufner M, Becker W. Factors influencing the dosimetry and the therapeutic outcome of I-131 therapy of differentiated thyroid cancer (DTC) [abstract]. *J Nucl Med.* 2001;42(suppl):242P.
5. Sinyuta B, Dzhuzha D. The influence of diagnostic radiation absorbed doses and time interval on the degree of thyroid stunning [abstract]. *Eur J Nucl Med.* 2001;28:1004.

Mario Medvedec, MD
University Hospital Rebro
Zagreb, Croatia

REPLY: We appreciate the interest and comments expressed in the Letter to Editor concerning our paper (*1*). The author of the Letter recalls intuitively appealing characteristics of biphasic curves and suggests these characteristics to be completed. Good predictive properties of the biphasic model described in our paper indicate that a relation between administered activity and the curve parameters (maximum curve value and effective half-life) is nonlinear.

Consequently, these curve parameters (unlike residence time) are not invariant with respect to the administered activity, even when no radiobiological effects would exist. The primary aim of our study was not an examination of radiobiological effects but an attempt to suppress the influence of some other factors not related to biological effects of ionizing radiation. We believe that better data obtained using the improved data acquisition scheme proposed in our article will provide appropriate material for examination of thyroid stunning and other radiobiological effects.

REFERENCES

1. Hermanska J, Karny M, Zimak J, et al. Improved prediction of therapeutic absorbed doses of radioiodine in the treatment of thyroid carcinoma. *J Nucl Med.* 2001;42(7):1084–1090.

Jindriska Hermanska, PhD
Ladislav Jirsa, PhD
Academy of Sciences of the Czech Republic
Praha, Czech Republic