# Post-surgical ablation of thyroid residues with radioiodine in Ukrainian children and adolescents affected by post-Chernobyl differentiated thyroid cancer

V. Oliynyk\*, O. Epshtein\*, T. Sovenko\*, M. Tronko\*, R. Elisei\*\*, F. Pacini\*\*, and A. Pinchera\*\*

\*Institute of Endocrinology and Metabolism, Kiev, Ukraine; \*\*Department of Endocrinology and Metabolism, University of Pisa, Pisa, Italy

ABSTRACT. Post-surgical ablation of thyroid residues with 131-iodine (131-I) is usually recommended after near-total thyroidectomy in highrisk patients, including children, with differentiated thyroid cancer (DTC). We report here the results of post-surgical radioiodine thyroid ablation in 249 children and adolescents of Ukraine with post-Chernobyl DTC initially treated with neartotal thyroidectomy at the Institute of Endocrinology and Metabolism in Kiev, during a 2-year period. The patients' age at the time of the Chernobyl accident (1986), ranged from <1 to 14 yr in 223 subjects (children) and from 15 to 18 yr in 26 subjects (adolescents). Six weeks after surgery a diagnostic <sup>131</sup>-I whole body scan revealed the presence of residual thyroid tissue in all cases. All patients received one or more courses of radioiodine therapy, for a total of 468 courses. One hundred and twenty-nine out of 249 pa-

#### INTRODUCTION

The primary aim of treatment of differentiated thyroid cancer (DTC) is the achievement of definitive cure and long-term survival associated with a normal quality of life (1, 2). The selection of effective treatment modality is of paramount importance in achieving this goal. Due to the benign natural history of most DTC, particularly papillary (3), several issues related to the more appropriate treatment modality have been debated for many years, mainly the extent of initial surgery and the need for post-surgical thyroid abla-

Accepted May 2, 2001.

tients (51.8%) were successfully ablated. The total number of treatment courses needed in these patients was 219. Most patients required multiple doses of radioiodine, only 63 required a single dose. One hundred and twenty patients (48.2%) treated with radioiodine were not ablated and are still under treatment program. The clinical features and the amount of thyroid residue were not different in ablated or not-ablated patients. Our results indicate that in this particular population of post-Chernobyl thyroid carcinomas, thyroid ablation is a rather difficult task. Only 51.8% were successfully ablated. Possible explanation for this finding may be the young age of the patients, other particular features of post-Chernobyl thyroid carcinoma or technical aspects, such as less radical surgical procedures.

(J. Endocrinol. Invest. 24: 445-447, 2001) ©2001, Editrice Kurtis

tion with radioiodine (4-6). The arguments in favor of total (or near-total) thyroidectomy are based on the high incidence of multifocal disease within the thyroid gland (7) and on the higher sensitivity of serum thyroglobulin (Tg) measurement and of <sup>131</sup>-I whole body scanning in the post-surgical follow-up (8-10). Furthermore, several authors have shown that both the long-term survival and the disease-free survival improve after total thyroidectomy when compared to less total surgical procedures (11, 12). The issue of multifocality is particularly compelling in the case of radiation-induced papillary thyroid cancer as observed in the post-Chernobyl epidemic of childhood thyroid carcinoma (13-15). In this particular age group, the need for a second operation for recurrent thyroid disease exposes the young patients to a very high risk of laryngeal nerve injuries, permanent hypoparathyroidism and other surgical complications. In addition, post-Chernobyl thyroid carcinoma is often as-

Key-words: Childhood thyroid cancer, <sup>131</sup>-I ablation, post-Chernobyl carcinoma.

*Correspondence*: Dr. Furio Pacini, Department of Endocrinology, University of Pisa, Via Paradisa 2, 56124 Pisa, Italy.

*E-mail:* fpacinii@endoc.med.unipi.it

sociated with local and distant metastases (mainly to the lungs), which can be successfully discovered and treated by radioiodine therapy only after complete thyroid ablation (16). The same arguments in favor of radical surgery can be advocated also for the use of post-surgical radioiodine ablation of thyroid residues. We report here the results of post-surgical radioiodine thyroid ablation in 249 children and adolescents of Ukraine with post-Chernobyl DTC initially treated with near-total thyroidectomy (17).

#### PATIENTS AND METHODS

The study group included 249 patients (167 females, 82 males) with post-Chernobyl DTC treated at the Institute of Endocrinology and Metabolism in Kiev, during a 2-yr period. The patients' age at the time of the Chernobyl accident (1986), ranged from <1 to 14 yr in 223 subjects (children) and from 15 to 18 yr in 26 (adolescents). In all cases initial surgery was performed in Kiev by the same surgical team adopting the technique of near-total thyroidectomy by principle. Six-eight weeks after surgery, in hypothyroid state, patients were submitted to <sup>131</sup>-I whole body scanning in order to assess the presence and the extent of thyroid residues and/or metastases. When present, thyroid residues were treated with radioiodine therapy, at a dose depending on the amount of residual tissue, the degree of thyroid bed iodine uptake and the concomitant presence of metastases. Diagnostic and therapeutic radioiodine preparations were purchased from Amersham (UK). Radioiodine scanning was performed using a gammacamera (ADAC, The Netherlands). Radioiodine therapy was administered at the Institute of Endocrinology and Metabolism in Kiev.

## RESULTS

Radioiodine scan performed 6 weeks after surgery revealed the presence of residual thyroid tissue in all cases. Thus, all patients underwent the administration of one or more courses of radioiodine therapy, for a total of 468 courses. One hundred and twenty-nine out of 249 patients (51.8%) were successfully ablated. The total number of treatment courses needed in these patients was 219. As shown in Figure 1, one single treatment (35-145 mCi) was needed in 63 patients, two treatments were needed in 45 (60-300 mCi), three treatments in 19 (100-300 mCi), four treatments in 1 (360 mCi) and five treatments in 1 (370 mCi).

One hundred and twenty patients treated with radioiodine were not ablated and are still under treatment program. The number of doses administered in these patients was one in 49 patients, two in 26,



Fig. 1. - Cumulative doses of radioiodine (mCi) and number of courses needed for thyroid ablation in 129 patients successfully ablated.

three in 28, four in 8 and five in 9 (400-600 mCi). The clinical features and the amount of thyroid residue were not different in ablated or not ablated patients.

## DISCUSSION

Radioiodine therapy is a safe and useful procedure for the post-surgical ablation of thyroid residues (18). Usually, one single treatment is sufficient to achieve complete thyroid ablation in 65-90% of the cases, but a significant proportion of patients may require additional treatment (19). The factors affecting the rate of successful ablation are not fully understood, but probably include size of the residue, radioiodine uptake, TSH levels and iodine intake (20, 21). It is worth noting that all the relevant data available in the literature deal with series of adult patients with DTC.

The present study is the first to report the effect of radioiodine thyroid ablation in a series of radiationinduced thyroid carcinomas in the particular age group of children and adolescents. Our results indicate that in this particular population, thyroid ablation is a rather difficult task. Only 129/249 patients (51.8%) were ablated, and among them, only 63 were ablated with a single dose of radioiodine. Additional courses of radioiodine were required in most patients, and even this was not sufficient to get rid of thyroid remnants in many patients.

The reason(s) for these findings is not apparent. Age of the patients might be important. Although the young thyroid gland is particularly sensitive to radiation, this may not necessarily mean that is easy to be destroyed. The machinery of DNA repair and the replication potential might be very effective in young patients compared to adults, and might counterbalance the destructive potential of radioiodine. In view of the high rate of multicentricity of post-Chernobyl thyroid cancer, another possibility is that these residues may be a combination of normal cells and neoplastic cells, the latter being more resistant to the effect of radioiodine. Other factors to be considered may be represented by as yet unknown peculiarities of post-Chernobyl thyroid carcinomas, although technical aspects, such as less radical surgical procedures cannot be ruled out.

### ACNOWLEDGMENTS

This study has been supported in part by grant from European Communities: INCO-Copernicus Project (IC15-CT980314); MURST (ex 40%) 2000.

#### REFERENCES

- Dulgeroff A.J., Hershman J.M. Medical therapy for differentiated thyroid carcinoma. Endocr. Rev. 1994, 15: 500-515.
- Solomon D.L., Wartofsky L., Burman K.D. Current trends in the management of well differentiated papillary thyroid carcinoma. J. Clin. Endocrinol. Metab. 1966, *81*: 333-339.
- Schlumberger M. Papillary and follicular thyroid carcinoma. N. Engl. J. Med. 1998, 338: 297-306.
- De Groot L.J., Reilly M. Comparison of 30-and 50-mCi doses of iodine-131 for thyroid ablation. Ann. Inter. Med. 1982, 96: 51-53.
- Goolden A.W.G. The use of radioactive iodine in thyroid carcinoma. Eur. J. Cancer Clin. Onc. 1988, 24: 339-343.
- Wartofsky L., Sherman S.I., Gopal J., Schlumberger M., Hay I.D. Therapeutic controversy. The use of radioactive iodine in patients with papillary and follicular thyroid cancer. J. Clin. Endocrinol. Metab. 1998, 83: 4195-4203
- Grebe S.K.G., Hay I.D. Follicular cell-derived thyroid carcinoma. In: Arnold A. (Ed.), Endocrine neoplasms. Kluwer Academic Publishers, Boston, 1997, p. 91.
- Pacini F., Lari R., Mazzeo S., Grasso L., Taddei D., Pinchera A.
  Diagnostic value of a single serum thyroglobulin determination on and off thyroid suppressive therapy in the follow-up of patients with differentiated thyroid cancer.

Clin. Endocrinol. (Oxf). 1985, 23: 405-411.

- Pacini F., Elisei R., Fugazzola L., Cetani F, Romei C, Mancusi F, Pinchera A. Post-surgical follow-up of differentiated thyroid cancer. J. Endocrinol. Invest. 1995, 18: 165-166.
- Schlumberger M., Baudin E. Serum thyroglobulin determination in the follow up of patients with differentiated thyroid carcinoma. Eur. J. Endocrinol. 1998, 138: 249-252.

- Dean D.S., Hay I.D. Prognostic indicators in differentiated thyroid carcinoma. Cancer Control 2000, 7: 229-239.
- Mazzaferri E.L. Long-term outcome of patients with differentiated thyroid carcinoma: effect of therapy. Endocr. Pract. 2000, *6:* 469-476.
- Nikiforov Y., Gnepp D.R. Pediatric thyroid cancer after the Chernobyl disaster. Pathomorphologic study of 84 cases (1991-1992) from the republic of Belarus. Cancer 1994, 74: 748-766.
- Williams E.D., Pacini F., Pinchera A. Thyroid cancer following Chernobyl. J. Endocrinol. Invest. 1995, 18: 144-146.
- Pacini F., Vorontsova T., Demidchik E.P., Molinaro E., Agate L., Romei C., Shavrova E., Cherstvoy E.D., Ivashkevitch Y., Kuchinskaya E., Schlumberger M., Ronga G., Filesi M., Pinchera A. Post-Chernobyl thyroid carcinoma in Belarus children and adolescents: comparison with naturally occurring thyroid carcinoma in Italy and France. J. Clin. Endocrinol. Metab. 1997, *82*: 3563-3569.
- Schlumberger M., Arcangioli O., Piekarski J.D., Tubiana M., Parmentier C. Detection and treatment of lung metastases of differentiated thyroid carcinoma in patients with normal chest x-ray. J. Nucl. Med. 1988, *29*: 1790-1794.
- Tronko M., Bogdanova T., Komissarenko I.V., Epstein O.V., Oliynyk V., Kovalenko A., Likhtarev I.A., Kairo I., Peters S.B., LiVolsi V.A. Thyroid carcinoma in children and adolescents in Ukraine after the Chernobyl nuclear accident. Cancer 1999, 86: 149-156.
- Maxon III H.R., Smith H.S. Radioiodine-131 in the diagnosis and treatment of metastatic well differentiated thyroid cancer. Endocrinol. Metab. Clin. North Am. 1990, *19*: 685-718.
- Samuel A.M., Rajashekharrao B. Radioiodine therapy for well-differentiated thyroid cancer: a quantitative dosimetric evaluation for remnant thyroid ablation after surgery. J. Nucl. Med. 1994, 35: 1944-1950.
- De Klerk J.M.H., De Keizer B., Zelissen P.M.J., Lips C.M.J., Koppeschaar H.P.F. Fixed dosage of 131-I for remnant ablation in patients with differentiated thyroid carcinoma without pre-ablative diagnostic 131-I scintigraphy. Nucl. Med. Commun. 2000, *21*: 529-532.
- Doi S.A.R., Woodhouse N.J.Y. Ablation of the thyroid remnant and 131-I dose in differentiated thyroid cancer. Clin. Endocrinol. (Oxf.) 2000, 52: 765-773.