Appendix 7

Thyroid Cancer of Ukrainians having been Exposed as Children or Adolescents as a Result of the Chernobyl Accident

THYROID CANCER OF UKRAINIANS HAVING BEEN EXPOSED AS CHILDREN OR ADOLESCENTS AS A RESULT OF THE CHERNOBYL ACCIDENT

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INTRODUCTION

The increase in thyroid cancer incidence among children and adolescents having been exposed to radiation following the Chernobyl accident (aged 0 to 18 years at the time of the accident) may be considered today as a proved fact (Likhtarev I.A. et al., 1995; Demidchik E.P. et al., 1996; Tronko N..D., Bogdanova T.I., 1997, 1999; Jacob P., 1998, 2002; Tronko N.D. et al., 1999, 2002, 2002a; Tsyb A.F. et al., 1999). In previous years, the attention of most investigators had been focused on the analysis of thyroid cancer cases revealed in childhood (0 to 14 years at surgery), because such a group of radiation-exposed subjects had no analogues in the international medical practice. In time, the population of affected subjects "become adult", and then elder age groups already need a thorough study. Changes in the character of tumour progression, morphological features of carcinomas made it necessary to revise traditional methods of diagnosis and treatment of thyroid cancer, introduce into clinical practice modern approaches: preoperative fine-needle aspiration biopsy, express-histological intraoperative study, improvement of surgical tactics, thorough postoperative follow-up of patients using radioiodine therapy (Komissarenko I.V. et al., 1996; Bolgov M.Yu. Et al., 1999; Epshtein E.V. et al., 1999; Tronko N.D. et al., 1999, 2002a; Oliynik V. et al., 2001).

A parallel study of carcinoma using methods of immunohistochemistry, in situ hybridization and molecular biology enabled to clear up some aspects of their biological behaviour (Williams E.D., Tronko N.D., 1996; Tronko N.D., Bogdanova T.I., 1997; Thomas G.A. et al., 1999, 1999a; Bogdanova T.I et al., 1999, 1999a, 2000; Santoro M. et al., 2000). The whole complex of above-mentioned measures led to a significant improvement of the level of diagnosis and treatment of thyroid carcinomas in patients having been exposed to radiation in their childhood and adolescence.

We have carried out an analysis of the clinico-morphological Register of thyroid cancer - established at the Institute of Endocrinology and Metabolism of the Academy of Medical

Sciences of Ukraine - in persons who were aged up to 18 years at the time of the accident, and morphological analysis of carcinomas removed in this category of patients for the period 1986-2002.

OBJECT AND METHODS OF INVESTIGATION

The clinico-morphological Register has been established at the Institute of Endocrinology and Metabolism of the Academy of Medical Sciences of Ukraine in 1992 on the base of statistical reports on the number of thyroid cancer cases in subjects aged 0-18 years at the time of the Chernobyl accident in all 27 regions of Ukraine, and on a review of medical records of patients having undergone surgical or postoperative treatment at the Hospital of the Institute of Endocrinology. Also the incidence per 100 thousand representatives of different age populations has been calculated, and a comparison made of the incidence rate for 6 regions of Ukraine being the most contaminated by iodine radionuclides (Kiev, Chernigov, Zhytomir, Rovno, Cherkassy regions, and City of Kiev) and the other 21 regions of Ukraine for the period from 1986-2002. The Register data are regularly renewed by adding extra information.

Now our register is a part of National Cancer Register, which has been established at the Institute of Oncology of the Academy of Medical Sciences of Ukraine in 1995 for all ages [Fedorenko Z.P. et al., 2001; Shalimov S.A. et al., 2001]. There are some differences between two registers. Our register includes only thyroid cancer cases of special age group at the time of the Chernobyl accident (high risk group for development of thyroid cancer), and only cases after surgical treatment with pathology confirmation of diagnosis. Cancer register includes also some cases without surgical treatment, just with cytology conclusion after fine needle aspiration biopsy. In our register a calculation of cases at oblast level was based on place of residence of patients at the time of accident, but in Cancer register such calculation has been based on place of residence of patients at the time of surgery. So, these differences should be taken into account for the comparison of the obtained results.

As has been mentioned above, pathology confirmation is an indispensable condition for including every case in our register. Such confirmation has been performed in hospital, when patients were operated. The detailed morphological characteristics for this report have been estimated by means of a histological analysis of carcinomas obtained after surgical treatment of thyroid cancer patients at the Institute of Endocrinology and Metabolism of the Academy

of Medical Sciences of Ukraine, or based on material (paraffin blocks, histological specimens) forwarded to the Laboratory of Morphology of the Institute for consultative conclusion, for the period 1990-2002. Pathology diagnoses were based on WHO classification [Chr.Hedinger et al., 1988]. Most of the cases have been additionally studied by international experts. The diagnosis of carcinoma has been confirmed in all the cases under study.

RESULTS AND DISCUSSION

1. Statistical data.

When assessing the Register's data by age at the time of accident, it should be noted that for the post-Chernobyl period (1986-2002) 2674 cases of thyroid cancer in patients born in 1968-1986 (0 to 18 years at the time of the accident) have been reported; among them 1887 were children aged up to 15 during the accident (0 to 14 at the time of the accident), and 787 were adolescents aged 15 to 18. Ratio Female to Male for these age groups increased with age at the time of accident: 1415:472 (3:1) for children and 646:141 (4.6:1) for adolescents (tables 1.1-1.2). The increase in the number of thyroid cancer cases was the most pronounced in those who were children aged up to 15 during the Chernobyl accident (table 1.1). So, if for the period 1986-1989, when increase of thyroid cancer have not been observed, the number of cases in this age group was 54 (on average 13 per year), in 1990-1995 475 cases (on average 79 per year), and in 1996-2001 1115 cases (on average 186 per year) have been registered. In 2002 the number of cancer cases in the above age group has reached 243.

Calculation of incidence per 100 thousand children aged 0 to 14 years (at the time of the accident) showed that as a whole for the Ukraine this indicator was 0.12 in 1986-1989. In 1990-1995 it has increased by 5.8 (0.70), and in 1996-2001 by 13.8 times (1.65) as compared to the period 1986-1989 (table 1.1). In 2002 the incidence in children's cohort at the time of the accident (2.16) was 18.0 times higher than in 1986-1989. It should be taken into account, that during the period 1990-2002 cohort's age become elder year by year, what could explain such an increase in incidence of thyroid cancer.

But, the rise in the incidence occurred mainly at the expense of the 6 above regions of Ukraine being the most contaminated by iodine radioisotopes following the accident (table 1.1). In these 6 regions the incidence in the period 1986-1989 was 0.16 per 100 thousand population, what practically did not differ from the other 21 regions (0.11). In 1990-1995 the

incidence in the 6 regions has increased up to 1.82, and in 1996-2001 up to 4.11, being 4.2 and 3.9 times as high as for the other regions (0.43 and 1.05, respectively). In 2002 the incidence in the most contaminated regions (5.54) also exceeded by 4.2 times this indicator for the rest of the territory of Ukraine (1.33). The data obtained demonstrate that the increase in the incidence of thyroid cancer in children at the time of the accident is basically connected with radiation, but not with the fact the cohort become elder.

An analysis of the numbers and incidence of malignant thyroid tumours among adolescents aged 15 to 18 (at the time of the Chernobyl accident) has shown a less marked rise in this pathology (table 1.2). The number of thyroid cancer cases in this group of patients in 1986-1989 was equal to 49 (on average 12 per year), in 1990-1995 233 (on average 39 per year), and in 1996-2001 417 (on average 70 cases per year). In 2002 the number of cancer cases in the above age group has reached 88.

This was also confirmed by calculating the number of cancer cases per 100 thousand adolescents' population (15 to 18 years at the time of the Chernobyl accident), what pointed out that over the period under study the incidence has increased in this age group less markedly: 0.45 in 1986-1989; 1.40 in 1990-1995, and 2.51 in 1996-2001. In 2002 the incidence among adolescents at the time of the accident was 3.18, exceeding by 7.1 times the indicator for 1986-1989.

In the 6 most affected regions, thyroid cancer incidence in adolescents (at the time of the accident) also did not exceed the incidence for the rest of the territory of Ukraine in 1986-1989 (0.46 vs. 0.44). In 1990-1995 thyroid cancer incidence in adolescents exceeded the incidence for the rest of the territory of Ukraine by 1.7 times (2.05 vs. 1.24); in 1996-2001 by 2.0 times (4.16 vs. 2.11), and in 2002 by 2.7 times (6.43 vs. 2.38), i.e. the increase is much less marked compared to children at the time of the accident (table 1.2).

By their age at surgery, the above patients were distributed as follows: 448 were children aged up to 15 (292 F, 156 M; F:M=1.9:1); 468 were adolescents aged 15 to 18 at surgery; (326 F, 142 M; F:M=2.3:1) and 1758 were young adults aged 19 to 34 years, being children and adolescents during the accident (1443 F, 315 M; F:M=4.6:1). If we add to the above cases 62 ones reported in children born after the Chernobyl accident (41 F, 21 M; F:M=2:1), the

Register for the period in question comprises 2736 cases of thyroid carcinomas, and ratio Female to Male increased with age at the time of surgery.

The rate of growth of the incidence was the highest in children having been operated at the age up to 15 years and such a growth was reported beginning from 1990 (table 1.3). The incidence per 100 thousand children's population in Ukraine as a whole for the period 1986-1989 varied within the range 0.07 to 0.10 (0.08 on average). In 1990-1995 this indicator increased by 4.8 times (0.38), and in 1996-2001 by 4.5 times (0.36) as compared to the average rate in 1986-1989. Maximum incidence rates have been reported in 1996 (0.55). In the following years the incidence for the group 0 to 14 years (at surgery) was decreasing.

At the same time, if we consider the incidence separately for children who were exposed following the Chernobyl accident (born before 1987), and for those having not been exposed (born in 1987 and later), it is evident (table 1.4) that in the group of exposed children there is no decrease in the incidence, and, on the contrary, in 1998-2000 the highest indicators have been reported in this group. In 2001 two cases were observed in children who were "in utero" in 1986. While in non-exposed children the average incidence per 100 thousand population aged from 0 to 14 years for the period 1995–2001 practically did not exceed level in 1986-1989, and was equal to 0.08. It should be stressed that this indicator increased in 2002 until 0.35, being 4.4 times higher than the previous indicator.

If we consider the number and incidence separately for children who were born in 1986 (children aged less than 4 months or "in utero" during the accident), it is evident (table 1.5) that in this age group the incidence is the same or lower compared with children born before the accident (table 1.4). An increase in the incidence in 2001-2002 may be explained by the fact that in these years, subjects born in 1986 have been represented by adolescents, which have similar indicators of incidence in this period (table 1.6).

The rise in the incidence as a whole among children aged from 0 to 14 years occurred mainly at the expense of the above regions being the most contaminated by iodine radioisotopes (table 1.3). In these 6 regions the average annual incidence for the period 1986-1989 was 0.10, and practically did not differ from the other 21 regions (0.08). In 1990-1995 it has increased in the above 6 regions up to 1.24, being 7.3 times as high as the total rate for the

other 21 regions (0.17). In 1996-2001 the incidence in 6 regions was 1.11, being 5.8 times as high as in other regions (0.19). In 2002 the incidence per 100 thousand children in the 6 above regions (0.72) exceeded by 2.8 times the average rate for the rest of the territory of Ukraine (0.26).

At the same time, if we consider the incidence separately for children who were exposed following the Chernobyl accident (born before 1987), and for those having not been exposed (born in 1987 and later), it is evident that in the group of exposed children there is a marked difference in incidence between 6 and 21 regions during the period 1990-2000 (table 1.4). While in non-exposed children there was no significant difference in incidence between 6 and 21 regions for the 1995-2000 period (0.07 vs. 0.04). But, it should be stressed that such a difference increased in 2001-2002 by 2.6 times (0.51 vs. 0.20), which needs further analysis in the process of data collection.

An analysis of the incidence of malignant thyroid tumours in adolescents having been operated at the age of 15 to 18, has shown that a reliable increase in the number of malignant thyroid tumours in adolescents was reported later than in children: beginning from 1994 (table 1.6). This is also confirmed by calculating the number of cancers per 100 thousand adolescents' population, showing that over the period under study the incidence among adolescents in Ukraine has exceeded the average level during the 1986-1989 period (0.40) by 1.9 time (0.76) in 1990-1995, by 3.4 (1.36) in 1996-2001, by 3.3 times (1.32) in 2002. Thus, no decrease in the incidence over the period under study has been noted in adolescents (at the moment of surgery).

In the 6 most affected regions thyroid cancer incidence in adolescents exceeded that for the rest of the territory of Ukraine in 1990-1995 by 2.7 times (1.55 vs. 0.57), in 1996-2001 by 5.0 (3.83 vs. 0.76), and in 2002 by 7.3 times (4.35 vs. 0.60). Thus, a difference in adolescents' incidence between 6 and 21 regions increased with time elapsed after the accident (table 1.6).

The number of thyroid cancer cases in young adults who were aged up to 18 years at the time of the accident for the period 1986-2002 was equal to 1758 (table 1.7). For the period under study, the age of the patients of this group was increasing from 19 (in 1987) to 34 (in 2002). Calculation of incidence per 100 thousand population, aged 19 and more (at the time of

surgery), showed that for the whole of Ukraine this indicator was 0.55 in 1987-1989. In 1990-1995 it has increased by 1.9 (1.02), and in 1996-2001 by 3.7 times (2.05) as compared to the period 1986-1989 (table 1.7). In 2002 the incidence in adult's cohort at the time of surgery (2.55) was 4.6 times higher than in 1986-1989.

In the 6 most affected regions thyroid cancer incidence in young adults (at the time of surgery) exceeded that for the rest of the territory of Ukraine in 1990-1995 only by 1.8 times (1.72 vs. 0.95), in 1996-2001 by 2.5 times (4.00 vs. 1.57), and in 2002 by 3.4 times (5.88 vs. 1.73). Thus, the difference in adults' incidence between 6 and 21 regions is lowest compared with children and adolescents, and becomes more significant from 1998 (table 1.7).

Thus, we may conclude that during the post-latent period after the Chernobyl accident (1990-2002) we have observed a significant increase of the number and incidence of thyroid cancer cases in the cohort aged 0-18 years at the time of accident, especially in children aged 0-14 at the time of accident.

By their age at surgery, an increase in the incidence of thyroid cancer was also observed in all age groups: children until 15, adolescents 15-18, and young adults aged more than 19. The rate of growth of the incidence was the highest in children having been operated at the age up to 15 years and it was reported beginning from 1990. The rise in the incidence occurred mainly at the expense of the 6 above regions of Ukraine being the most contaminated by iodine radioisotopes following the accident. Ratio Female to Male increased with age of the subjects at the time of accident and at the time of surgery.

2. Pathology data.

2.1. Patients born in 1985-1968.

A morphological analysis for this age group has been conducted, of 1009 cases of thyroid carcinomas removed in patients aged 4 to 34 years at surgery (0-18 years old at the time of accident). The analysis has been performed separately for 3 age groups at the time of surgery (children aged from 4 to 14, adolescents aged from 15 to 18, and young adults aged from 19 to 34), and for all patients born in 1985-1968 for the 3 periods: (from 1990 to 1995, from 1996 to 2001, and for 2002). Ratio Female to Male was 176:96 (1.8:1) in children, 137:69

(2:1) in adolescents, and 422:109 (3.9:1) in young adults (tables 2.1-2.3), which was approximately the same as in these age groups for the whole of Ukraine (tables 1.4, 1.6, 1.7).

This analysis showed that in all age groups and in all periods of observation more than 90% of cases have been represented by papillary carcinomas (tables 2.1-2.4). Follicular carcinoma has been reported in 3.3% of cases in children, in 5.8% - in adolescents, and in 4.1% of cases in young adults for 1990-2002 period (tables 2.1-2.3). There is some increase of percentage of follicular carcinoma in patients born in 1985-1968 with time: from 3% in 1990-1995 to 6.1% in 2002 (table 2.4). Medullary carcinoma has been found in 3.7% of cases in children, and in 1.7% in young adults for all the period of observation. There was no increase with age or time in this type of thyroid carcinoma. Anaplastic carcinoma has been reported only in two adolescents in 1990-1995 period. The above data have shown that - with rare exception - thyroid carcinomas in patients who were children or adolescents during the Chernobyl accident, were represented by papillary type. There is some increase of percentage of follicular carcinoma in all age groups with time elapsed after the accident..

Tumour size and histological peculiarities have been analysed for 754 thyroid carcinomas, when we had clear pathology information about tumour size. This analysis was performed separately for papillary (710 cases), follicular (31 cases) and medullary (13 cases) carcinomas.

For all age groups and all periods of observation, papillary carcinomas from 1 to 3 cm in diameter were dominant (tables 2.5-2.8). In all age groups, isolated cases of extensive tumours (more than 5 cm) were reported, which affected one or both thyroid lobes. Out of 710 patients with papillary carcinoma 8 cases in children (3.4%), 19 – in adolescents (14.4%) and 50 – in adults (14.6%) were represented by tumours up to 1 cm for all the period of observation (tables 2.5-2.7). Totally in all age groups 77 such tumours (10.9%) were registered for the 1990-2002 period (table 2.8). At the same time, it should be noted that in 1996-2001, and in 2002 the percentage of these “small” carcinomas was increasing. If in 1990-1995 only 8 “small” tumours out of 196 papillary carcinomas (4.1%) were registered, in 1996-2001 their number has increased up to 49 out of 416 (11.8%), exceeding by 2.9 times the previous indicator, and in 2002 their number has increased up to 20 out of 98 (20.4%), exceeding by 5 times the indicator for 1990-1995 (table 2.8). An increase in number and

percentage of "small" tumours may be connected with intensification of screening, because in the process of special screening examinations in the framework of the Ukraine-U.S. Thyroid Project the percentage of such "small" tumours was 23.3% during 1st screening (10 cases out of 43 thyroid carcinomas, revealed in 1998-2000 in 13227 screened subjects), and 38.1% during 2nd one (8 cases out of 21 thyroid carcinomas, revealed in 2001-2003 in 11559 screened subjects) [M.D.Tronko et al., 2003].

An analysis of the signs of extrathyroid spreading of carcinomas (T4 category by TNM classification) depending on tumour size shows that among children tumours with any size referred to T4 category were more often reported than among adolescents and young adults (tables 2.9-2.11). Among tumours up to 1 cm, two out of 8 carcinomas (25.0%) spread outside thyroid capsule and were referred to T4 category. Practically for any size of tumour more than 1 cm among children most of carcinomas belonged to T4 category (table 2.9) in both periods: 1990-1995 and 1996-2000 (in 2001 and 2002 children born before 1986 were absent). Among adolescents and young adults bigger tumours measuring more than 3 cm were referred more often to T4 category (table 2.10, 2.11). It should be stressed that percentage of papillary carcinoma with extrathyroid spreading for all 710 cases decreased with time elapsed after the accident for any size of tumour (table 2.12). So, extrathyroid spreading depended on age of operated patients and time elapsed after the Chernobyl accident.

It should be stressed that minimum tumour size - up to 1 cm - does not exclude the development of regional metastases, which were observed in children in 12.5% of cases (1 out of 8), in adolescents in15.8% (3 out of 19) and in 20.0% in young adults (10 out of 50). The percentage of regional metastases increased in all age groups with tumour's size (tables 2.13-2.16). The highest percentage of regional metastases in 1990-2002 period was observed in children (68.6%), and the lowest – in young adults (38.6%). The percentage of regional metastases for all 710 cases decreased in time elapsed after the accident for any size of tumour (table 2.16). So, presence of regional metastases, as well as extrathyroid spreading of the papillary carcinomas, depended on age of operated patients and time elapsed after the Chernobyl accident.

The size of 31 follicular carcinomas was considered for all patients born in 1985-1968. Out of them just one tumour up to 1 cm was observed in 1996-2001 period, what is 3.2% from total

number (table 2.17). Follicular carcinomas were bigger than papillary ones: 58.1% of them had size more than 3 cm whereas among papillary carcinomas only 31.4% of cases were bigger than 3 cm. In spite of a larger size follicular carcinomas were represented by less aggressive tumours: just one wide invasive case with size 5.2 cm was associated with extrathyroid spreading and lymph nodes metastases.

The size of 13 medullary carcinomas was also considered for all patients born in 1985-1968. Out of them one tumour up to 1 cm was observed in 2002, what is 7.7% from total number (table 2.18). Medullary carcinomas were also larger than papillary ones: 46.2% out of them had size more than 3 cm. 6 out 13 tumours (46.2%) had signs of extrathyroid spreading and were referred to T4 category, and also 6 (46.2%) had regional metastases (N1a,b category).

2.2. Patients, born in 1986.

53 cases of thyroid cancer detected in children born in 1986 for the period 1990-2002 have been included in the clinico-morphological Register. There is complete information on the date of birth and date of surgery for all patients. Out of 53 children born in 1986, 32 were born before the 26.04.1986, and 21 (39.6%) after the 26.04.1986, i.e. during the Chernobyl accident the latter were in prenatal period of development.

We have carried out a morphologic analysis of 41 out of 53 cases, or 77.4% (table 2.19). 27 out of 41 tumours were removed in children aged up to 15 (17 out of them were born before the 26.04.1986, and 10 after this date), and 14 cases in adolescents aged 15 to 18 years (10 out of them were born before the 26.04.1986, and 4 after this date). Totally, 27 thyroid carcinomas (16 F and 11 M, F:M=1.5:1) were removed in patients born before the 26.04.1986 (1^{st} series), and 14 (7 F and 7 M, F:M=1:1) – in patients born after this date (2^{nd} series).

The data obtained point out that the majority of thyroid cancer cases in both series under study represented a papillary carcinoma: 92.6% cases of patients born before the Chernobyl accident, and 71.5% of cases of children who were “in utero” during the accident. Follicular carcinomas were represented by one case in the 1^{st} series and two cases in 2^{nd} one. Medullary carcinoma were represented by one case in both series, and an oxyphilic-cell carcinoma - by one case in the 2^{nd} series (table 2.19). So, the distribution of the types of thyroid carcinomas seems to be wider in patients who were “in utero” compared to patients, born in 1986 before

the Chernobyl accident, but the number of the cases “in utero” is too small for any conclusion.

As to the size of papillary carcinomas, we have not observed significant differences between two series (table 2.20), as well as their signs of extrathyroid spreading (table 2.21), and presence of regional metastases (table 2.22). Tumours measuring from 1.1 cm to 3 cm were dominant in both series, and tumours of such size more often had signs of extrathyroid spreading and regional metastases.

Thus, in subjects born in 1986 (before or after the Chernobyl accident) papillary carcinomas are dominant with similar signs of extrathyroid spreading and presence of regional metastases.

2.3. Patients, born in 1987 and later.

62 cases of thyroid cancer detected in children born after the Chernobyl accident in 1987 and later for the period 1995-2002 have been included in the Register. Complete information is available on the date of birth and date of surgery for all patients.

We have carried out a morphologic analysis of 57 out of 62 above cases (36 F and 21 M, F:M=1.7:1), or 91,9% (table 2.23). 45 out of 57 cases under study, or 78.9% were represented by papillary carcinoma; 8 cases (14.1%) - by follicular carcinoma; and 4 cases (7.0%) - by medullary carcinoma. It should be stressed a higher percentage of follicular carcinomas as compared to children born before the accident (tables 2.1, 2.19), but it is similar to percentage of follicular carcinoma (11%) in non-exposed children from England and Wales [H.R.,Harach, E.D. Williams, 1995].

As to the size of papillary carcinomas (table 2.24), it should be stressed a higher percentage of tumours with minimum size up to 1 cm (18.4%) compared to carcinoma of such size in children born before the accident (tables 2.5, 2.20).

Signs of extrathyroid spreading in papillary carcinomas of children born in 1987 and later (table 2.25) are approximately the same as in papillary carcinomas of children born before the accident (tables 2.9, 2.21).

The same tendency was noted when making a comparative analysis of carcinoma size and presence of regional metastases (tables 2.14, 2.22, 2.26). Only "small" tumours up to 1 cm were not associated with development of regional metastases in children born in 1987 and later.

Thus, in subjects born in 1987 and later papillary carcinomas are dominant, and are associated with high invasive features in the presence of a primary focus measuring more than 1 cm. "Small" tumours up to 1 cm in this age group did not manifest lymphoid metastatic spreading. It should be stressed a higher rate of follicular carcinoma cases in this age group as compared to children born before the accident.

Taking into account certain changes in morphological features, and size of papillary carcinomas with increasing age of patients and latent period of tumour development (if 1986 is taken as a starting point), undoubtedly it would be important to conduct a comparative analysis of incidence and clinico-morphological features of thyroid carcinomas in different age groups both at the time of accident and surgery. In this context, detailed immunohistochemical, molecular-biology studies would also be of paramount importance, and this is just the object of a large-scale international Project for establishing a bank of tissue, RNA and DNA extracts from post-Chernobyl thyroid tumours (Thomas G. et al., 2000). Such investigations, if we take into consideration the interest - over 50 years - to the situation after the atomic bombardment of Hiroshima and Nagasaki (Ezaki H., 1995; Nagataki Sh., 1999), will remain a subject of interest for many years.

CONCLUSIONS

- After the Chernobyl accident (during the 1990-2002 period) a significant increase of the number and incidence of thyroid cancer cases in the cohort aged 0-18 years at the time of accident were observed, especially in children aged 0-14 at the time of accident.

- By cohort' age at surgery, an increase of incidence in thyroid cancer was also observed in all age groups: children until 15, adolescents 15-18, and young adults aged more than 19. The rate of growth of the incidence was the highest in children having been operated at the age up to 15 years, and it was reported beginning from 1990. The rise in the incidence occurred mainly at the expense of the 6 regions of Ukraine being the most contaminated by iodine radioisotopes following the accident. Ratio Female to Male increased with age of the subjects at the time of accident and at the time of surgery.

- Thyroid carcinomas of patients who were children or adolescents during the Chernobyl accident, were represented by papillary type in most of the cases. There is some increase in percentage of follicular carcinoma in all age groups with time elapsed after the accident.

- An increase in percentage of tumors measuring up to 10 mm was registered in adolescents and young adults (at surgery) with increasing time elapsed after the Chernobyl accident.

- Extrathyroid spreading and presence of regional metastases depended on the age of operated patients and time elapsed after the Chernobyl accident. These indicators were the highest in children and lowest in young adults. For all age groups the percentage of cases with signs of extrathyroid spreading and presence of regional metastases decreased with time elapsed after the accident for any size of tumours.

- In patients born in 1986 (before or after the Chernobyl accident) papillary carcinomas are dominant with similar signs of extrathyroid spreading and presence of regional metastases.

- In children born in 1987 and later papillary carcinomas are dominant, and are associated with high invasive features in the presence of a primary focus measuring more than 1 cm. "Small" tumours up to 1 cm in this age group did not manifest lymphoid metastatic spreading. It should be stressed a higher percentage of follicular carcinomas in this age group as compared to children born before the accident. Such a comparison has a preliminary character and needs further analysis in the process of data collection.

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Table 1.1 Number of thyroid cancer cases and incidence per 100 thousand children population in 1986 (aged 0-14 years at the time of the Chernobyl accident)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number Female	4	9	7	17	25	31	57	53	76	87	97	106	133`	158	143	219	193
Number Male	4	2	4	7	17	15	26	30	28	30	41	30	37	59	37	55	50
Total number	8	11	11	24	42	46	83	83	104	117	138	136	170	217	180	274	243
Total incidence	0.07	0.10	0.10	0.21	0.37	0.41	0.74	0.74	0.92	1.04	1.23	1.21	1.51	1.93	1.60	2.44	2.16
6 reg. incidence	0.14	0.00	0.14	0.36	0.72	1.04	2.12	1.94	2.39	2.70	3.11	2.57	3.60	4.91	4.37	6.12	5.54
21 reg.incidence	0.06	0.12	0.09	0.18	0.29	0.25	0.40	0.44	0.56	0.63	0.76	0.87	1.00	1.20	0.92	1.53	1.33

Table 1.2 Number of thyroid cancer cases and incidence per 100 thousand adolescents population in 1986 (aged 15-18 years at the time of the Chernobyl accident)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number Female	9	8	9	9	19	19	26	39	34	58	44	50	69	59	56	72	66
Number Male	2	6	2	4	1	4	9	7	9	8	10	11	12	8	13	13	22
Total number	11	14	11	13	20	23	35	46	43	66	54	61	81	67	69	85	88
Total incidence	0.40	0.51	0.40	0.47	0.72	0.83	1.26	1.66	1.55	2.38	1.95	2.20	2.93	2.42	2.49	3.07	3.18
6 reg. incidence	0.18	1.10	0.00	0.55	1.10	1.47	1.84	1.84	2.02	4.04	2.57	3.49	5.33	3.12	4.77	5.69	6.43
21 reg.incidence	0.45	0.36	0.49	0.45	0.63	0.67	1.12	1.62	1.44	1.98	1.80	1.89	2.34	2.25	1.93	2.43	2.38

Table 1.3 Number of thyroid cancer cases and incidence per 100 thousand children population (aged 0-14 years at the date of surgery)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number Female	4	8	5	7	15	17	33	28	27	34	33	30	33	16	17	8	18
Number Male	4	2	3	4	12	7	20	19	19	12	22	7	12	10	7	8	9
Total number	8	10	8	11	27	24	53	47	46	46	55	37	45	26	24	16	27
Total incidence	0.07	0.09	0.07	0.10	0.24	0.22	0.48	0.43	0.43	0.45	0.55	0.38	0.48	0.29	0.28	0.20	0.35
6 reg. incidence	0.14	0.00	0.09	0.18	0.51	0.66	1.75	1.43	1.41	1.65	1.85	1.43	1.48	0.97	0.54	0.37	0.72
21 reg.incidence	0.06	0.11	0.07	0.08	0.18	0.11	0.18	0.19	0.20	0.16	0.24	0.13	0.24	0.13	0.22	0.15	0.26

Table 1.4 Number of thyroid cancer cases and incidence per 100 thousand children population aged 0-14 years at the date of surgery (born before 1987 or in 1987 and later)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Born before 1987																	
Number Female	4	8	5	7	15	17	33	28	27	33	33	29	31	14	8	-	-
Number Male	4	2	3	4	12	7	20	19	19	12	20	7	11	8	6	2	-
Total number	8	10	8	11	27	24	53	47	46	45	53	36	42	22	14	2	
Total incidence	0.07	0.10	0.08	0.12	0.33	0.32	0.77	0.77	0.85	0.97	1.37	1.16	1.80	1.41	1.80	0.02	
6 reg. incidence	0.14	0.00	0.11	0.23	0.69	0.96	2.81	2.54	2.78	3.67	4.78	4.32	5.78	5.01	4.67	0.06	
21 reg.incidence	0.06	0.12	0.08	0.10	0.24	0.16	0.29	0.34	0.39	0.32	0.55	0.40	0.85	0.56	1.12	0.02	
Born in 1987 and later																	
Number Female										1	-	1	2	2	9	8	18
Number Male	-	-	-	-	-	-	-	-	-	-	2	-	1	2	1	6	9
Total number	-	-	-	-	-	-	-	-	-	1	2	1	3	4	10	14	27
Total incidence	-	-	-	-	-	-	-	-	-	0.02	0.03	0.02	0.04	0.05	0.13	0.17	0.35
6 reg. incidence	-	-	-	-	-	-	-	-	-	0.00	0.00	0.08	0.07	0.14	0.13	0.31	0.72
21 reg.incidence	-	-	-	-	-	-	-	-	-	0.02	0.04	0.00	0.04	0.03	0.13	0.14	0.26

Table 1.5 Number of thyroid cancer cases and incidence per 100 thousand population (patients born in 1986 at the date of surgery)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number Female	-	-	-	-	-	-	1	2	1	2	1	2	5	2	4	7	6
Number Male	-	-	-	-	1	-	3	3	2	-	1	-	-	1	3	4	2
Total number	-	-	-	-	1	-	4	5	3	2	2	2	5	3	7	11	8
Total incidence	-	-	-	-	0.13	-	0.51	0.64	0.38	0.26	0.26	0.26	0.64	0.38	0.89	1.40	1.02
6 reg. incidence	-	-	-	-	0.67	-	2.02	1.35	1.35	1.35	0.67	1.35	1.35	-	1.35	3.37	4.05
21 reg.incidence	-	-	-	-	-	-	0.16	0.47	0.16	-	0.16	-	0.47	0.47	0.79	0.94	0.31

Table 1.6 Number of thyroid cancer cases and incidence per 100 thousand adolescents population (aged 15-18 years at the date of surgery)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number Female	9	5	6	14	10	14	17	15	22	22	22	17	21	41	28	35	28
Number Male	2	5	2	3	5	6	3	6	8	8	10	8	16	19	11	17	13
Total number	11	10	8	17	15	20	20	21	30	30	32	25	37	60	39	52	41
Total incidence	0.69	0.35	0.27	0.57	0.50	0.67	0.67	0.71	1.01	1.02	1.09	0.85	1.25	1.99	1.28	1.67	1.32
6 reg. incidence	0.18	0.71	0.17	0.68	0.84	1.19	1.21	1.56	3.11	1.39	2.09	2.26	2.93	5.46	4.90	5.35	4.35
21 reg.incidence	0.45	0.26	0.30	0.55	0.42	0.54	0.54	0.50	0.50	0.93	0.85	0.51	0.84	1.16	0.41	0.80	0.60

Table 1.7 Number of thyroid cancer cases in young adults (aged 19-34 years at the date of surgery)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Number Female	-	4	5	5	19	19	33	49	61	90	86	110	150	162	163	256	231
Number Male	-	1	1	4	1	6	12	12	10	18	21	26	22	40	33	49	59
Total number	-	5	6	9	20	25	45	61	71	108	107	136	172	202	196	305	290
Total incidence	-	0.75	0.46	0.44	0.72	0.71	1.05	1.21	1.23	1.67	1.50	1.74	2.02	2.19	1.97	2.87	2.55
6 reg. incidence	-	1.51	0.00	0.76	1.12	1.47	1.57	1.43	1.51	3.24	2.50	2.40	3.92	4.34	4.44	6.38	5.88
21 reg.incidence	-	0.56	0.57	0.37	0.63	0.53	0.93	1.16	1.16	1.29	1.26	1.58	1.55	1.66	1.37	2.00	1.73

Table 2.1. Main types of the thyroid carcinoma in children 4-14 years old who were born before 1986 (272 cases for the 1990-2000 period)

Histological type	1990-1995				1996-2000				2001-2002				1990-2000			
	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num	%
Papillary carcinoma	96	57	153	93.3	66	34	100	92.6	-	-	-	-	162	91	253	93.0
Follicular carcinoma	2	2	4	2.4	4	1	5	4.6	-	-	-	-	6	3	9	3.3
Medullary carcinoma	6	1	7	4.3	2	1	3	2.8	-	-	-	-	8	2	10	3.7
Oxyphilic cell carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anaplastic carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	104	60	164		72	36	108		-	-	-	-	176	96	272	

Table 2.2. Main types of the thyroid carcinoma in adolescents 15-18 years old who were born before 1986 (206 cases for the 1990-2002 period)

Histological type	1990-1995				1996-2001				2002				1990-2002			
	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num	%
Papillary carcinoma	24	12	36	92.3	87	43	130	92.0	17	9	26	96.3	128	64	192	93.2
Follicular carcinoma	1	-	1	2.6	7	3	10	7.1	-	1	1	3.7	8	4	12	5.8
Medullary carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxyphilic cell carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anaplastic carcinoma	1	1	2	5.2	-	-	-	-	-	-	-	-	1	1	2	1.0
Total	26	13	39		94	46	140		17	10	27		137	69	206	

Table 2.3. Main types of the thyroid carcinoma in young adults 19-34 years old who were born in 1968 and later (531 cases for the 1990-2002 period)

Histological type	1990-1995				1996-2001				2002				1990-2002			
	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num	%
Papillary carcinoma	24	4	28	90.3	279	71	350	96.2	95	27	122	89.9	398	102	500	94.2
Follicular carcinoma	-	2	2	6.5	9	2	11	3.0	9	-	9	6.6	18	4	22	4.1
Medullary carcinoma	1	-	1	3.2	2	1	3	0.8	3	2	5	3.7	6	3	9	1.7
Oxyphilic cell carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anaplastic carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	25	6	31		290	74	364		107	29	136		422	109	531	

Table 2.4. Main types of the thyroid carcinoma in patients who were born in 1985-1968 (1009 cases for the 1990-2002 period)

Histological type	1990-1995				1996-2001				2002				1990-2002			
	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num.	%	F	M	Total num	%
Papillary carcinoma	144	73	217	92.7	432	148	580	94.8	112	36	148	90.8	688	257	945	93.7
Follicular carcinoma	3	4	7	3.0	20	6	26	4.2	9	1	10	6.1	32	11	43	4.3
Medullary carcinoma	7	1	8	3.4	4	2	6	1.0	3	2	5	3.1	14	5	19	1.9
Oxyphilic cell carcinoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anaplastic carcinoma	1	1	2	0.9	-	-	-	-	-	-	-	-	1	1	2	0.2
Total	155	79	234		456	156	612		124	39	163		735	274	1009	

Table 2.5. Size of papillary thyroid carcinomas in children 4-14 years old who were born before 1986 (236 cases for the 1990-2000 period)

Size of the tumour	1990-1995		1996-2000		2001-2002		1990-2000	
	n	%	n	%	n	%	n	%
< = 1cm	5	3.3	3	3.5	-	-	8	3.4
1.1 - 2 cm	58	38.7	49	57.0	-	-	107	45.3
2.1 – 3 cm	42	28.0	5	5.8	-	-	47	19.9
3.1 – 4 cm	14	9.3	9	10.5	-	-	23	9.7
4.1 – 5 cm	18	12.0	10	11.6	-	-	28	11.9
5.1 – 6 cm	9	6.0	6	7.0	-	-	15	6.4
> 6 cm	4	2.7	4	4.6	-	-	8	3.4
Total	150		86		-	-	236	

Table 2.6. Size of papillary thyroid carcinomas in adolescents 15-18 years old who were born before 1986 (132 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	n	%	n	%	n	%
< = 1cm	1	3.8	16	18.0	2	11.8	19	14.4
1.1 - 2 cm	6	23.1	42	47.2	8	47.0	56	42.4
2.1 – 3 cm	9	34.6	13	14.6	4	23.5	26	19.7
3.1 – 4 cm	6	23.1	8	9.0	2	11.8	16	12.1
4.1 – 5 cm	1	3.8	7	7.9	1	5.9	9	6.8
5.1 – 6 cm	1	3.8	2	2.2	-	-	3	2.3
> 6 cm	2	7.7	1	1.1	-	-	3	2.3
Total	26		89		17		132	

Table 2.7. Size of papillary thyroid carcinomas in young adults 19-34 years old who were born in 1968 and later (342 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	n	%	n	%	n	%
< = 1cm	2	10.0	30	12.4	18	22.2	50	14.6
1.1 - 2 cm	5	25.0	107	44.4	30	37.0	142	41.5
2.1 – 3 cm	5	25.0	44	18.3	16	19.8	65	19.0
3.1 – 4 cm	3	15.0	24	10.0	6	7.4	33	9.7
4.1 – 5 cm	3	15.0	18	7.5	4	4.9	25	7.3
5.1 – 6 cm	1	5.0	9	3.7	5	6.2	15	4.4
> 6 cm	1	5.0	9	3.7	2	2.5	12	3.5
Total	20		241		81		342	

Table 2.8. Size of papillary thyroid carcinomas in patients who were born in 1985-1968 (710 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	N	%	n	%	n	%
< = 1cm	8	4.1	49	11.8	20	20.4	77	10.9
1.1 - 2 cm	69	35.2	198	47.6	38	38.8	305	43.0
2.1 – 3 cm	56	28.6	62	14.9	20	20.4	138	19.4
3.1 – 4 cm	23	11.7	41	9.8	8	8.2	72	10.1
4.1 – 5 cm	22	11.2	35	8.4	5	5.1	62	8.8
5.1 – 6 cm	11	5.6	17	4.1	5	5.1	33	4.6
> 6 cm	7	3.6	14	3.4	2	2.0	23	3.2
Total	196		416		98		710	

Table 2.9. Extra-thyroid spreading (T4-category of TNM classification) and size of papillary thyroid carcinomas in children 4-14 years old who were born before 1986 (236 cases for the 1990-2000 period)

Size of the tumour	1990-1995		1996-2000		2001-2002		1990-2000	
	n	%	n	%	n	%	n	%
< = 1cm	1/5	20.0	1/3	33.3	-	-	2/8	25.0
1.1 - 2 cm	35/58	60.3	27/49	55.1	-	-	62/107	57.0
2.1 – 3 cm	29/42	69.0	4/5	80.0	-	-	33/47	70.2
3.1 – 4 cm	11/14	71.4	6/9	66.7	-	-	17/23	73.9
4.1 – 5 cm	15/18	83.3	5/10	50.0	-	-	20/28	71.4
5.1 – 6 cm	6/9	66.7	6/6	100	-	-	12/15	80.0
> 6 cm	3/4	75.0	4/4	100	-	-	7/8	87.5
Total	100/150	66.7	53/86	61.6	-	-	153/236	64.8

Table 2.10. Extra-thyroid spreading (T4-category of TNM classification) and size of papillary thyroid carcinomas in adolescents 15-18 years old who were born before 1986 (132 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	N	%	N	%	n	%	n	%
< = 1cm	0/1	-	3/16	18.8	0/2	-	3/19	15.8
1.1 - 2 cm	4/6	66.7	15/42	35.7	2/8	25.0	21/56	37.5
2.1 – 3 cm	2/9	22.2	5/13	38.5	3/4	75.0	10/26	38.5
3.1 – 4 cm	2/6	33.3	4/8	50.0	1/2	50.0	7/16	43.8
4.1 – 5 cm	1/1		1/7	14.3	1/1		3/9	33.3
5.1 – 6 cm	0/1		2/2		-	-	2/3	66.7
> 6 cm	2/2		1/1		-	-	3/3	100
Total	11/26	42.3	31/89	34.8	7/17	41.2	49/132	37.1

Table 2.11. Extra-thyroid spreading (T4-category of TNM classification) and size of papillary thyroid carcinomas in young adults 19-34 years old who were born in 1968 and later (342 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	n	%	n	%	n	%
< = 1cm	0/2	-	4/30	13.3	2/18	11.1	6/50	12.0
1.1 - 2 cm	1/5	20.0	32/107	29.9	8/30	26.7	41/142	28.8
2.1 – 3 cm	2/5	40.0	18/44	40.9	4/16	25.0	24/65	36.9
3.1 – 4 cm	2/3	66.7	13/24	54.2	1/6	16.7	16/33	48.5
4.1 – 5 cm	2/3	66.7	6/18	33.3	1/4	25.0	9/25	36.0
5.1 – 6 cm	1/1		7/9	77.8	1/5	20.0	9/15	60.0
> 6 cm	1/1		4/9	44.4	1/2	50.0	6/12	50.0
Total	9/20	45.0	84/241	34.9	18/81	22.2	111/342	30.7

Table 2.12. Extra-thyroid spreading (T4-category of TNM classification) and size of papillary thyroid carcinomas in patients who were born in 1985-1968 (710 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	N	%	n	%	n	%
< = 1cm	1/8	12.5	8/49	16.3	2/20	10.0	11/77	14.3
1.1 - 2 cm	40/69	58.0	74/198	37.4	10/38	26.3	124/305	40.7
2.1 – 3 cm	33/56	58.9	27/62	43.5	7/20	35.0	67/138	48.6
3.1 – 4 cm	15/23	65.2	23/41	56.1	2/8	25.0	40/72	55.6
4.1 – 5 cm	18/22	81.8	12/35	34.3	2/5	40.0	32/62	51.6
5.1 – 6 cm	7/11	63.6	15/17	88.2	1/5	20.0	23/33	69.7
> 6 cm	6/7	85.7	9/14	64.3	1/2	50.0	16/23	69.6
Total	120/196	61.2	168/416	40.4	25/98	25.5	313/710	44.1

Table 2.13. Presence of the regional metastases (N1a,b -category of TNM classification) and size of papillary thyroid carcinomas in children 4-14 years old who were born before 1986 (236 cases for the 1990-2000 period)

Size of the tumour	1990-1995		1996-2000		2001-2002		1990-2000	
	n	%	N	%	n	%	n	%
< = 1cm	1/5	20.0	0/3	-	-	-	1/8	12.5
1.1 - 2 cm	33/58	56.9	37/49	75.5	-	-	70/107	65.4
2.1 – 3 cm	28/42	66.7	3/5	60.0	-	-	31/47	66.0
3.1 – 4 cm	11/14	78.6	6/9	66.7	-	-	17/23	73.9
4.1 – 5 cm	14/18	77.8	8/10	80.0	-	-	22/28	78.6
5.1 – 6 cm	8/9	88.9	6/6	100	-	-	14/15	93.3
> 6 cm	3/4	75.0	4/4	100	-	-	7/8	87.5
Total	98/150	65.3	64/86	74.4	-	-	162/236	68.6

Table 2.14. Presence of the regional metastases (N1a,b -category of TNM classification) and size of papillary thyroid carcinomas in adolescents 15-18 years old who were born before 1986 (132 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	n	%	n	%	n	%
< = 1cm	0/1	-	3/16	18.8	0/2	-	3/19	15.8
1.1 - 2 cm	3/6	50.0	14/42	33.3	4/8	50.0	21/56	37.5
2.1 – 3 cm	2/9	22.2	7/13	53.8	2/4	50.0	11/26	42.3
3.1 – 4 cm	4/6	66.7	7/8	87.5	2/2		13/16	81.3
4.1 – 5 cm	0/1		5/7	71.4	1/1		6/9	66.7
5.1 – 6 cm	1/1		2/2		-	-	3/3	100
> 6 cm	2/2		1/1		-	-	3/3	100
Total	12/26	46.2	39/89	43.8	9/17	52.9	60/132	45.5

Table 2.15. Presence of the regional metastases (N1a,b -category of TNM classification) and size of papillary thyroid carcinomas in young adults 19-34 years old who were born in 1968 and later (342 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	n	%	n	%	n	%
< = 1cm	0/2	-	6/30	20.0	4/18	22.2	10/50	20.0
1.1 - 2 cm	1/5	20.0	43/107	40.2	8/30	26.7	52/142	36.7
2.1 – 3 cm	1/5	20.0	19/44	43.2	5/16	31.3	25/65	38.5
3.1 – 4 cm	0/3	-	13/24	54.2	2/6	33.3	15/33	45.5
4.1 – 5 cm	1/3	33.3	10/18	55.6	2/4	50.0	13/25	52.0
5.1 – 6 cm	0/1	-	8/9	88.9	2/5	40.0	10/15	66.7
> 6 cm	1/1		5/9	55.6	1/2	50.0	7/12	58.3
Total	4/20	20.0	104/241	43.2	24/81	29.6	132/342	38.6

Table 2.16. Presence of the regional metastases (N1a,b -category of TNM classification) and size of papillary thyroid carcinomas in patients who were born in 1985-1968 (710 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	N	%	n	%	n	%
< = 1cm	1/8	12.5	9/49	18.4	4/20	20.0	14/77	18.2
1.1 - 2 cm	37/69	53.6	94/198	47.5	12/38	31.6	143/305	46.9
2.1 – 3 cm	31/56	55.4	29/62	46.8	7/20	35.0	67/138	48.6
3.1 – 4 cm	14/23	60.9	26/41	63.4	4/8	50.0	45/72	62.5
4.1 – 5 cm	15/22	68.2	23/35	65.7	3/5	60.0	41/62	66.1
5.1 – 6 cm	9/11	81.8	16/17	94.1	2/5	40.0	27/33	81.8
> 6 cm	6/7	85.7	10/14	71.4	1/2	50.0	17/23	73.9
Total	114/196	58.2	207/416	49.8	33/98	33.7	354/710	49.9

Table 2.17. Size of follicular thyroid carcinomas in patients who were born in 1985-1968 (31 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	n	%	n	%	n	%
< = 1cm	-	-	1	5.0	-	-	1	3.2
1.1 - 2 cm	1	16.7	1	5.0	2	40.0	4	12.9
2.1 – 3 cm	1	16.7	6	30.0	1	20.0	8	25.8
3.1 – 4 cm	4	66.6	5	25.0	-	-	9	29.0
4.1 – 5 cm	-	-	4	20.0	2	40.0	6	19.4
5.1 – 6 cm	-	-	3*	15.0	-	-	3	9.7
> 6 cm	-	-	-	-	-	-	-	-
Total	6		20		5		31	

*** - 1 case with size 5.2 cm (T4N1a,b)**

Table 2.18. Size of medullary thyroid carcinomas in patients who were born in 1985-1968 (13 cases for the 1990-2002 period)

Size of the tumour	1990-1995		1996-2001		2002		1990-2002	
	n	%	N	%	n	%	n	%
< = 1cm	-	-	-	-	1 T4N1a,b	20.0	1 T4N1a,b	7.7
1.1 - 2 cm	-	-	-	-	2	40.0	2	15.4
2.1 – 3 cm	1	25.0	1 T4N1a,b	25.0	2	40.0	4 1-T4N1a,b	30.7
3.1 – 4 cm	2 T4N1a,b	50.0	-	-	-	-	2 T4N1a,b	15.4
4.1 – 5 cm	1 N1a,b	25.0	-	-	-	-	1 T4N1a,b	7.7
5.1 – 6 cm	-	-	2 1-T4N1a,b	50.0	-	-	2 1-T4N1a,b	15.4
> 6 cm	-	-	1	25.0	-	-	1	7.7
Total	4		4		5		13	

Table 2.19. Main types of the thyroid carcinoma in children who were born in 1986 (before and after 26.04.86) (41cases for the 1990-2002 period)

Histological type	Born before 26.04.86				Born after 26.04,86 but in 86 ("in utero")			
	F	M	Total Num.	%	F	M	Total Num.	%
Papillary carcinoma	15	10	25	92.6	5	5	10	71.5
Follicular carcinoma	-	1	1	3.7	1	1	2	14.3
Medullary carcinoma	1	-	1	3.7	1	-	1	7.1
Oxyphilic cell carcinoma	-	-	-	-	-	1	1	7.1
Anaplastic carcinoma	-	-	-	-	-	-	-	-
Total	16	11	27		7	7	14	

Table 2.20. Size of the thyroid carcinoma in children who were born in 1986 (before and after 26.04.86) (39 cases for the 1990-2002 period)

Size of the tumour	PTC				FC+OxyCr				MTC			
	Born before 26.04.86		Born after 26.04,86 ("in utero")		Born before 26.04.86		Born after 26.04,86 ("in utero")		Born before 26.04.86		Born after 26.04,86 ("in utero")	
	n	%	n	%	n	%	n	%	n	%	n	%
< = 1cm	1	4.3	1	10.0					1			
1.1 - 2 cm	9	39.2	5	50.0	1		1					
2.1 – 3 cm	6	26.1	2	20.0			1^{Oxy}					
3.1 – 4 cm	6	26.1	-	-							1	
4.1 – 5 cm	-	-	1	10.0								
5.1 – 6 cm	-	-	-	-			1					
> 6 cm	1	4.3	1	10.0								
Total	23		10		1		3		1		1	

Table 2.21. Extra-thyroid spreading (T4-category of TNM classification) and size of the thyroid carcinoma in children who were born in 1986 (before and after 26.04.86) (39 cases for the 1990-2002 period)

Size of the tumour	PTC				FC+OxyCr				MTC			
	Born before 26.04.86		Born after 26.04,86 ("in utero")		Born before 26.04.86		Born after 26.04,86 ("in utero")		Born before 26.04.86		Born after 26.04,86 ("in utero")	
	n	%	n	%	n	%	n	%	n	%	n	%
< = 1cm	0/1		0/1						1/1			
1.1 - 2 cm	5/7	71.4	4/5	80.0	0/1		0/1					
2.1 – 3 cm	4/6	66.6	0/2				0/1[Oxy]					
3.1 – 4 cm	3/6	50.0	-								0/1	
4.1 – 5 cm	-	-	1/1									
5.1 – 6 cm	-	-	-				0/1					
> 6 cm	1/1		1/1									
Total	13/23	56.5	6/10	60.0	0/1		0/3		1/1		0/1	

Table 2.22. Presence of the regional metastases (N1a,b -category of TNM classification) and size in children who were born in 1986 (before and after 26.04.86) (39 cases for the 1990-2002 period)

Size of the tumour	PTC				FC+OxyCr				MTC			
	Born before 26.04.86		Born after 26.04,86 ("in utero")		Born before 26.04.86		Born after 26.04,86 ("in utero")		Born before 26.04.86		Born after 26.04,86 ("in utero")	
	n	%	n	%	n	%	n	%	n	%	n	%
< = 1cm	1/1		1/1						1/1			
1.1 - 2 cm	5/7	71.4	4/5	80.0	0/1		0/1					
2.1 – 3 cm	5/6	83.3	0/2	-			0/1[Oxy]					
3.1 – 4 cm	4/6	66.7	-	-							0/1	
4.1 – 5 cm	-	-	1/1									
5.1 – 6 cm	-	-	-	-			0/1					
> 6 cm	1/1		1/1									
Total	15/23	65.2	7/10	70.0	0/1		0/3		1/1		0/1	

Table 2.23. Main types of the thyroid carcinoma in children who were born in 1987 and later (57 cases for the 1995-2002 period)

Histological type	F	M	Total number	%
Papillary carcinoma	27	18	45	78.9
Follicular carcinoma	7	1	8	14.1
Medullary carcinoma	2	2	4	7.0
Oxyphilic cell carcinoma	-	-	-	-
Anaplastic carcinoma	-	-	-	-
Total	36	21	57	

Table 2.24. Size of thyroid carcinoma in children who were born in 1987 and later (38 cases for the 1995-2002 period)

Size of the tumour	PTC		FC		MTC	
	n	%	n	%	n	%
< = 1cm	7	18.4	-		1	25.0
1.1 - 2 cm	12	31.6	1	14.3	1	25.0
2.1 – 3 cm	10	26.3	-		-	
3.1 – 4 cm	4	10.6	1	14,3	-	
4.1 – 5 cm	3	7.9	2	28.6	-	
5.1 – 6 cm	1	2.6	1	14.3	2	50.0
> 6 cm	1	2.6	2	28.6	-	
Total	38		7		4	

Table 2.25. Extra-thyroid spreading (T4-category of TNM classification) and size of thyroid carcinoma in children who were born in 1987 and later (38 cases for the 1995-2002 period)

Size of the tumour	PTC		FC		MTC	
	n	%	n	%	n	%
< = 1cm	1/7	14.3	-		1/1	
1.1 - 2 cm	6/12	50.0	0/1		1/1	
2.1 – 3 cm	7/10	70.0	-		-	
3.1 – 4 cm	3/4	75.0	0/1		-	
4.1 – 5 cm	3/3		0/2		-	
5.1 – 6 cm	1/1		0/1		2/2	
> 6 cm	1/1		0/2		-	
Total	21/38	55.3	0/7	0	4/4	100

Table 2.26. Presence of the regional metastases (N1a,b - category of TNM classification) and size of thyroid carcinoma in children who were born in 1987 and later (38 cases for the 1995-2002 period)

Size of the tumour	PTC		FC		MTC	
	n	%	n	%	n	%
< = 1cm	0/7	-	-		1/1	
1.1 - 2 cm	7/12	58.3	-		1/1	
2.1 – 3 cm	6/10	60.0	-			
3.1 – 4 cm	2/4	50.0	-			
4.1 – 5 cm	2/3	66.7	-			
5.1 – 6 cm	1/1		-		2/1	
> 6 cm	1/1		-			
Total	19/38	50.0	0/7	0	4/4	100