Thyroid cancer in children in Belarus

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Abstract

Paediatric thyroid cancer was diagnosed in 390 patients in Belarus after the Chernobyl accident. The morbidity rates increased by 55.7 times as compared with the 10 year pre-accident period. Thyroid cancer in children is highly aggressive disease accompanied by surrounding tissues and metastatic involvement of lymph nodes.

A sufficient increase of thyroid cancer incidence has become one of the serious consequences of the Chernobyl accident. For a nine year period after the catastrophe this disease was diagnosed in 210 children more as compared with the same pre-accident interim (Table 1).

Table 1

Thyroid cancer incidence in Belarus

Pre-accident period			Post accident period		
Years	Adults	Children	Years	Adults	Children
1977	121	2	1986	162	2
1978	97	2	1987	202	4
1979	101	0	1988	207	5
1980	127	0	1989	226	7
1981	132	1	1990	289	29
1982	131	1	1991	340	59
1983	136	0	1992	416	66
1984	139	0	1993	512	79
1985	148	1	1994	553	82
Total	1131	7	Total	2907	333

This perceptible increase in the incidence rate started 5 years after the accident in 1990 and by now the thyroid cancer has been diagnosed in 390 children (Table 2). 76.1% of them were from Gomel and Brest regions where the highest soil contamination with I^{131} has been observed. Boys and girls ratio was 1÷1.5 (Table 3).

Table 2

The incidence of thyroid cancer after the Chernobyl accident

Region	Years			
	1986-89	1990-94	7 months of 1995	Total
Brest	2	74	9	85
Vitebsk	0	7	0	7
Gomel	7	172	33	212
Grodno	5	14	3	22
Minsk	3	15	1	19
Mogilev	0	16	3	19
Minsk-city	1	17	8	26
Belarus	18	315	57	390
%	4.6	80.8	14.6	100

Table 3

Sex ratio for children

Region	Boys	Girls	Total
Brest	28	57	85
Vitebsk	3	4	7
Gomel	83	129	212
Grodno	12	10	22
Minsk	11	8	19
Mogilev	10	9	19
Minsk-city	10	16	26
Belarus	157	233	390
%	40.3	59.7	100

Radioactive iodine uptake by thyroid has become a certain cause of thyroid cancer in children. Childhood thyroid has a high capacity to accumulate radioactive isotopes and it is less tolerable to ionizing irradiation as compared with adults.

Thyroid cancer has mainly appeared in the children born before (380 cases) or at the time of the accident (6). "Spontaneous" carcinoma was diagnosed only in 4 children after I^{131} disintegration after the catastrophe.

The children irradiated at the age of 0-4 were at the highest risk of cancer promotion (Table 4). 17.9% patients of this group at the time of the accident were younger that one year of age.

The risk of radiation induced thyroid cancer developing in the children affected by the accident remains for long years and, possibly, for the whole life. Thyroid cancer was dignosed in 39 (10%) patients who were evacuated and migrated from the contaminated zones.

Table 4

The age of children at accident

Region	Number of cases	Age group		
		0-4	5-9	10-14
Brest	85	59	24	2
Vitebsk	7	4	3	0
Gomel	210	137	69	4
Grodno	21	9	11	1
Minsk	19	13	5	1
Mogilev	18	12	5	1
Minsk-city	26	17	8	1
Belarus	386	251	125	10
%	100	65.0	32.4	2.6

The most frequent histological type was papillary carcinoma (94.9%). Follicular tumors were verified in 4.3% and only two patients had anaplastic carcinomas. Only in one patient medullary tumor was diagnosed.

At the time of diagnosis carcinomas manifested themselves as nodules, while diffuse lesions were less common.

Of 380 children operated on in the Thyroid Cancer Center solitary carcinomas were in 64.5% cases and multifocal in 35.5%.

Tumors of more than 4 cm in size were rare. Tumor size didn't impact significantly the frequency of multifocal lesions. In the majority of patients the primary tumor had a high potential for invasion. Even small carcinomas (up to 8 mm) involved the thyroid capsula and the surrounding tissues. 48.4% of children had extracapsular spread of the tumor which corresponds to pT4. Capsular involvement formed mainly 3 months after a nodule was diagnosed.

Thyroid cancer in children frequently results in metastatic involvement of the regional lymph nodes. Approximately in one third of the patients (31.6%) metastatic disease of both neck sides was diagnosed before surgery. In many cases the rate of metastatic growth was significantly higher than the rate of primary tumor growth in the thyroid. The frequency of the regional nodes involvement depended directly on the tumor spread to the thyroid capsula and the surrounding tissues. The number of multifocal lesions was significantly higher in patients with extracapsular tumors. Thus, in our studies thyroid cancer was a rapidly developing disease.

When treating thyroid cancer in children it is not always clear whether thyroidectomy should be performed in every case. After a surgery of this kind a patient needs a high-doze thyroxine replacement therapy during all his life. It is doubtful that a long-term thyroxine therapy can completely replace the removed thyroid. It is this fact that in certain cases makes many surgeons perform smaller surgeries, such as subtotal resection and hemithyroidectomy. After these surgeries a small-doze thyroxine replacement therapy is quite effective.

It is not clear either whether wide neck dissection is necessary in cases when lymph node metastases in the neck and mediastinum are not routinely identified.

Our experience is based on the results of the follow-up of 380 children in the Center for Thyroid Cancer after the Chernobyl accident. In every case the diagnosis was histologically proved. The results of surgeries were reviewed and analyzed for 292 patients who were operated on 2 to 8 years ago.

In the first 5 years after the Chernobyl accident the surgical strategy was complete tumor removal and, where possible, preserving a part of the thyroid tissue to avoid heavy hypothyroidism difficult to treat with thyroxine (there was no L-thyroxine in Belarus at that time). Not only total thyroidectomy but also subtotal resection and hemithyroidectomy were performed. These surgical procedures resulted in paratracheal lymph nodes

dissection. If metastases were diagnosed in other neck regions, wide lymphadenectomy on one or both sides of the neck was performed.

In the following years hemithyroidectomy and subtotal resection of the thyroid was performed only in case of T1aNOMO, when a solitary carcinoma was 3 to 7 mm in size and there were no metastases in lymph nodes.

Of 292 children followed up during the period of 2 to 8 years after surgery in 56 (19,1 %) recurrences were observed. In 8 cases cancer was found in the parts of the thyroid saved at surgery. In 48 cases there were metastases in regional lymph nodes (Table 5). The interval between the first surgery and the time when carcinoma was observed in the thyroid remnants was 16,8 months. Lymph node metastases appeared 14 months after surgery. All 56 children were operated on again.

Table 5

Patterns of failure

Operation	Cases	Relapse	Regional metastases
Total thyroidectomy	106	0	12
Subtotal thyroidectomy	57	3	17
Hemithyroidectomy	129	5	19
Total (abs. and %)	292 (100%)	8 (2.7%)	48 (16.4%)

The most common postoperative complication was parathyroid insufficiency (Table 6). There were no lethal outcomes.

Table 6

Surgical morbidity

Complications	For primary surgery	For secondary surgery
N.recurrence damage:		
-unilateral	7	0
-bilateral	1	0
Parathyroid insufficiency	30	2
Ductus thoracicus damage	0	1
Total	38	4

Scintigraphy was usually performed after total thyroidectomy. When lung metastases appeared (55 cases) the patients had radioiodine therapy in the clinic of Professor Ch.Reiners (Essen, Germany).

Clinical and epidemiological studies showed that of the children affected by ionizing radiation during the accident those younger than 4 years of age were at the greatest risk in terms of developing thyroid cancer.

Thyroid cancer in children is of highly aggressive nature. Lymphogenic and hematogenic metastases often develop in cases of occult thyroid tumors and are hard to identify even through modern diagnostics. That is why complete removal of the thyroid and lymphadenectomy on both sides of the neck and anterior mediastinum can be considered as a curative surgical procedure. After such a surgery there is no source left for a relapse in the thyroid and regional lymph nodes. A smaller surgery (total thyroidectomy with no neck lymphadenectomy on both sides) is only relatively radical as it leaves a certain degree of risk of tumor developing. Nevertheless, this kind of surgery is very often acceptable. In a number of cases for pT1aN0M0 hemithyroidectomy can be performed. In such cases residual carcinoma is identified in 2,7% of patients.

Total thyroidectomy does not always save the parathyroid gland. Grafting of the removed parathyroid into a muscle does not eliminate parathyroid insufficiency. Short duration of the follow-up period of the patients who developed pulmonary and bone metastases and underwent radioiodine therapy does not allow to draw conclusions on the results of this strategy.

Besides it does not seem to be possible to evaluate the consequences of a long-term treatment of cancer in children with L-thyroxine which is a synthetic substance.

Thyroid cancer in children requires an early diagnosis as well as an adequate treatment procedure to get better long-term results without possible abnormalities.