

Thyroid hypoplasia in subjects exposed *in utero* and in early postnatal life to ionizing radiation due to the Chernobyl fallout

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Abstract

Background

Thyroid cancer in populations, especially in those exposed as children to ionizing radiation, in the result of the Chernobyl accident, is the only well-recognized consequence of this catastrophe. Whether other thyroid disorders found in people may be related or not to the exposure remains still a subject for discussions.

Aim

To show the results of ultrasound screening performed in different years after the accident in different contaminated regions of Belarus in subjects exposed to radiation *in utero* and during early years of life.

Results

The first study was performed in 1998, 12 years after the Chernobyl disaster, in one of the most contaminated Khoiniki district of Gomel region (South of Belarus). A non contaminated Braslav district from the North-West of Belarus had served as the control. In 390 children aged *in utero* to 1.5 y. at the moment of the disaster, thyroid hypoplasia was detected in 18 (4.6 %): 3.7 % and 5% in those exposed *in utero* and at the age of 0–1.5 y., respectively. According to the age of gestation, in children irradiated in the 1st trimester had the smallest thyroid size ($p < 0.01$), in them thyroid hypoplasia' rate was 8 %; in exposed during the 2nd trimester – 4.8%. No one child exposed in the 3rd trimester had small thyroid size. In 213 children from the control group, thyroid hypoplasia was detected only in 2 (0.01%), both were younger than 1.5 y. at the time of the accident. Furthermore, in children exposed in the 1st trimester of gestation, the highest rate of elevated TSH level ($p < 0.05$) and thyroid autoimmunity was noted.

The second screening was done in 2004–2007, in the most affected Stolin district of Brest region (South-West of Belarus). Among 209 subjects exposed to irradiation in early life, thyroid hypoplasia was found in 4.9%. The rate of hypoplasia in those suffered *in utero* was 7.1% ($p < 0.05$), and in exposed during the first 3 years of life – 2.7%. In the group of individuals irradiated in the first 12 weeks of gestation, 10.3% had thyroid hypoplasia ($p < 0.05$); in those exposed in the 2nd trimester of gestation - 4,3% and in irradiated during the 3rd trimester – 5.4% had thyroid hypoplasia, respectively. In the group of 237 individuals born after the accident, the rate of thyroid hypoplasia detected was 0.4% ($p < 0.01$).

Discussion and conclusion remarks

The two studies performed in different areas of Belarus contaminated by the Chernobyl fallout demonstrated increased rates of thyroid hypoplasia in people exposed *in utero*, with the highest rates in those affected by ionizing radiation during embryonic life (despite the minimal doses to the thyroid gland – according to an official opinion). The possible explanation of such phenomenon may be the exposure of the future thyroid cells from the surrounding irradiated

maternal tissues and/or *embryo* structures as thymus. Also, *embryo*' neural cells irradiation may lead to further changes in hypothalamo-pituitary-thyroid regulation resulting in the formation of the small-sized thyroid gland. Finally, one should consider the combined effect on the thyroid gland caused by ionizing radiation and other environmental disruptors, such as nitrates in water, as it has been recently demonstrated. However, the finding described cannot be negated and require studies from epidemiology, physics and genetics.