Epidemiology of thyroid cancer in Czech population after the Chernobyl accident

V. Sykorova¹, J. Grundloch², T. Halkova¹, E. Vaclavikova¹, S. Dvorakova¹, P. Vlcek³, B. Bendlova¹

¹Dept. of Molecular Endocrinology, Institute of Endocrinology, Prague; ²Czech Geological Survey, Prague; ³Department of Nuclear Medicine and Endocrinology, 2nd Faculty of Medicine, Charles University, Prague; Czech Republic
Incidence of thyroid cancer

- the most common type of endocrine malignancy
- increase over last decades, mainly PTC

Causes of increasing incidence:
- improvement of diagnosis, microcarcinoma
- changes in diagnostic criteria
- iodine over-supply
Chernobyl accident

- 26 April, 1986, Ukraine
- $2 \times 10^{18}$ Bq of iodine-131 (half-life is 8 days)
- increasing of PTC incidence in children
- effect on development of PTC in adults?
Chernobyl accident

Peterka et al., 2004
Chernobyl accident in Czech Republic

I
- 1: 30. 4. 86 – 2 h
- 2: 30. 4. 86 – 14 h

II
- from 4. 5. 86 – 2 h
to 5. 5. 86 – 14 h

III
- 1: from 8. 5. 86 – 2 h
to 9. 5. 86 – 2 h
- 2: from 7. 5. 86 – 2 h
to 7. 5. 86 – 14 h
- 3: 8. 5. 86 – 2 h

Kuchtova 2006
Levels of radioactivity in CR

Atmospheric aerosol:
- from the maximum value - about 257 Bq/m³ (April 30) – to 7 Bq/m³ (May 7)
- tellurium (Te$^{132}$), iodine (I$^{131}$), ruthenium (Ru$^{103}$) and caesium (Cs$^{137}$, Cs$^{134}$)

Whole body radioactivity:
- started in May 4, 1986
- from April 30 to May 3 has been estimated to be 9000 Bq/s

Peterka et al. 2003
Precipitation (30 April – 5 May, 1986)
$^{137}$Cs distribution in 1986

Kunz 1987 (modified)
Although the Czech Republic received only a relatively moderate amount of radioactive fallout, an unexpected uniformly accelerated increase of thyroid cancer in all age categories is seen from 1990 onwards.

S. Mürbeth

• 1976 – 1999
• 7,444 thyroid carcinoma patients
Aim of study

Evaluation of possible effect of radioactive fallout after Chernobyl accident on the incidence of thyroid cancer in the Czech regions using GIS
GIS

- Geographic information system
- a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data
- merges of cartography, statistical analysis, and database technology
- perspective tool for interdisciplinary studies including epidemiology
Czech Cancer Registry administrated by the Institute of Health Information and Statistics (IHIS) of the Czech Republic

- **14,676** thyroid cancer of Czech patients diagnosed from 1977 to 2009 (1:3.5 males vs females) with basic clinical and pathological data
- **7,587** PTC patients
- 206 regions of the Czech Republic (cca 15,000 inhabitants per region)
Prevalence of all thyroid carcinomas
Prevalence of thyroid ca 1977 - 1985
Prevalence of thyroid ca 1986 – 2009

PREVALENCE_100000
- 26.3 - 81.4
- 81.5 - 107.4
- 107.5 - 133.3
- 133.4 - 167.8
- 167.9 - 237.0

2nd Pannonia Congress of Pathology, Siófok, Hungary

17-19 May, 2012
Prevalence 1986 – 2009 vs $^{137}$Cs levels
Prevalence of all PTC
Prevalence of PTC 1977 - 1985
Prevalence of PTC 1986 – 2009
Prevalence of PTC 1986 – 2009 vs $^{137}$Cs
Conclusions

- Our pilot study did not confirm a direct effect of Chernobyl on prevalence of thyroid cancer, but geographic differences before and after Chernobyl were apparent.

- Effect of the other possible pathological factors (such as natural radiation, air pollution etc.) will be studied.

- The more detailed analysis of clinical-pathological data is planned.
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Thank you for your attention
Factors in the development of DTC

Landa I, Robledo M J Mol Endocrinol 2011;47:R43-R58
Regions of Czech Republic
# Chernobyl and thyroid cancer

<table>
<thead>
<tr>
<th>Mutation</th>
<th>RETPTC3</th>
<th>RETPTC1</th>
<th>BRAF, RAS, PAX8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumour</td>
<td>Pap Ca</td>
<td>Pap Ca</td>
<td>? Pap Ca *Foll Ca</td>
</tr>
<tr>
<td>Morphology</td>
<td>Solid variant</td>
<td>Classical</td>
<td>? Encapsulated</td>
</tr>
<tr>
<td>Clinical</td>
<td>Aggressive</td>
<td>Typical</td>
<td>? ‘benign’/typical</td>
</tr>
<tr>
<td>Latency</td>
<td>4–10 years</td>
<td>7–17 years</td>
<td>? 15–</td>
</tr>
</tbody>
</table>

*Estimated, (start-peak)*
Incidence of thyroid cancer in CR

C73 - Malignant neoplasm of thyroid gland

Time trend

1986

Source of data: UZIS CR

Analysed data: N(inc)=13756, N(mor)=3224

http://www.svod.cz
Loss of male fetuses after Chernobyl

Peterka et al. 2003

Peterka et al. 2003