



24 Year-old Female with Thyroid Nodule

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Endorama

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History of Present Illness

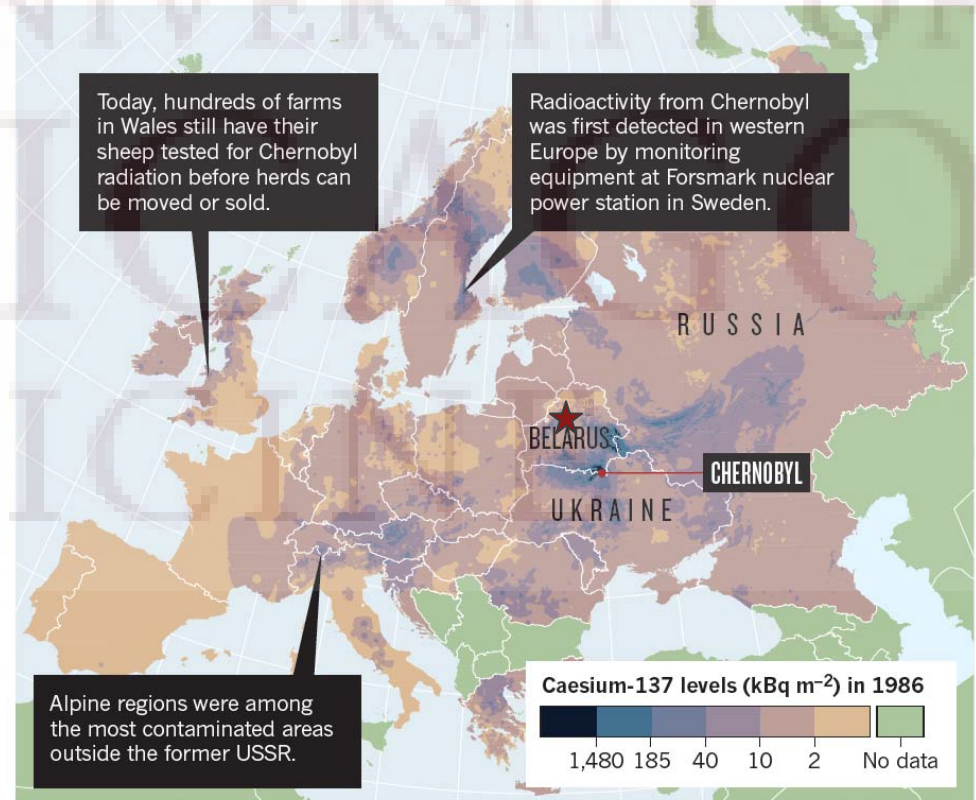
- 24-year-old female with a history of right-sided thyroid nodule who is self-referred for second opinion.
 - Her mother first noted the thyroid nodule when she was 15 years old.
 - Since then has been followed by at UIC.
 - FNA from February 2003 returned benign fluid.
 - Followed by ultrasound every 2 years, had been stable in size until the latest ultrasound in June 2011, which showed notable growth.
 - The patient herself has not noticed any difference in her thyroid nodules. Her mother feels that her nodule has grown.
 - No anterior neck discomfort, dysphagia, choking, shortness of breath, wheezing, or voice hoarseness.
 - Recent TFTs were reportedly normal.
 - Her endocrinologist had recommended waiting six months and if it was still increasing to perform a fine needle aspiration.

History of Present Illness



- Born on September 5, 1986, in Minsk, Belarus.

Chernobyl's reactor 4 exploded on April 26, 1986, releasing 6.7 tons of radioactive material, including 40 MCi of ^{131}I over 200,000 km² of Europe.



Chernobyl accident

EXPOSURE IN CONTEXT

Many emergency workers at Chernobyl received lethal doses of radiation, but the broader public, even those living in the contaminated zone, were exposed to levels on a par with some medical procedures.

Dose (mSv)	Source/implication
Up to 5,000	One minute's exposure to Chernobyl core shortly after explosion
1,000	Causes temporary radiation sickness, including nausea and decreased white-blood-cell count
250	Upper annual limit allowed for Fukushima emergency workers
120	Average total dose received by liquidators at Chernobyl (1986–90)
30	Average total dose of external radiation received by evacuees from Chernobyl plant and surrounding area
20	Average annual limit for nuclear-industry workers
9	Total dose received by the 6 million residents in contaminated areas ($>37 \text{ kBq m}^{-2}$) in former USSR
9	One computed-tomography (CT) scan
9	Annual exposure of airline crew flying regularly between New York and Tokyo
3	One mammogram
2.4	Average annual background radiation globally
0.3	Total dose received by each resident of Europe for 20 years after Chernobyl

Past Medical History

■ Past Medical History:

- Herniated lumbar disc with associated sciatica
- Status post tonsillectomy

■ Medications:

- NuvaRing

■ Family History:

- No thyroid cancer or disease.
- Mother, sister healthy.
- Father with hyperlipidemia.
- Paternal grandfather passed away from an arrhythmia.
- Paternal grandmother passed away from dementia.
- Maternal grandfather passed away from colon cancer at age of 87.

■ Social History:

- Moved to USA at 2 years old.
- Works as a law clerk during the day and attends law school at night.
- Has a boyfriend, no children.
- Smokes 1 pack over 2 weeks, since 18 years old
- Has 2-3 beers per week.

■ ROS:

- Gained 80 lbs from her freshman year of college until law school. With diet and exercise, she has lost 30 lbs in the last year.
- Chronic fatigue.
- Anxiety over examinations.
- Regular menses with NuvaRing.

Physical Examination

- VS: Weight 213.5 pounds, Height 5'10", BMI 30.6 kg/m², blood pressure 139/75, pulse 75.
- Gen: The patient appeared well and in no acute distress.
- HEENT: Conjunctivae were clear. Pupils were equally round and reactive to light. Extraocular movements were intact. Oropharynx exam revealed normal mucosa.
- Neck: 2 to 3 cm firm but nonadherent thyroid nodule on the right. No cervical lymphadenopathy was noted.
- Pulm: Lungs were clear.
- CV: Heart rate was regular. She had good peripheral pulses and no edema.
- Abdomen: Benign.
- Skin: Mild acne or rosacea on her forehead and nose.
- Neuro: Cranial nerves II-III were grossly intact. Deep tendon reflexes were normal. No tremors with her arms outstretched.

[Course

- Repeat FNA: atypical cells present, neoplasia not excluded.
 - Note: Most of the atypia is in the Thin Prep. Follow up suggested, including serum calcitonin.
- Calcitonin <5 (<8), TSH 1.52
- Thyroid uptake and scan:
 - Focus of decreased activity in the R mid to upper lobe, correlating with the palpable nodule.
 - 4 hour radioactive iodine uptake 11%, 24 hour 22% (10-30%).

[Surgical Referral]

- Recommended a total thyroidectomy.
- Patient preferred a R thyroid lobectomy.
- Underwent R thyroid lobectomy and isthmusectomy.
 - Pathology report revealed 3 cm PTC with negative margins, capsular invasion, and 0/1 lymph nodes.
- Underwent total thyroidectomy.
 - No tumor in L lobe.

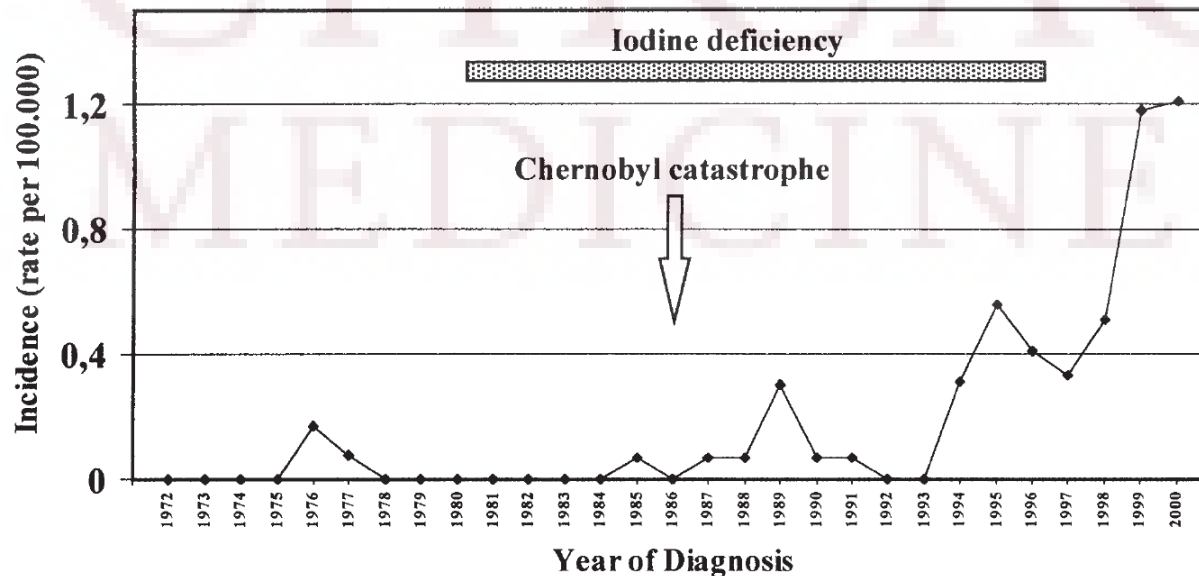
[Endocrine Follow up]

- Thyroid ultrasound with echogenic tissue within both lobectomy beds, may represent postoperative changes.
- Thyroglobulin 1 (TSH 0.14)

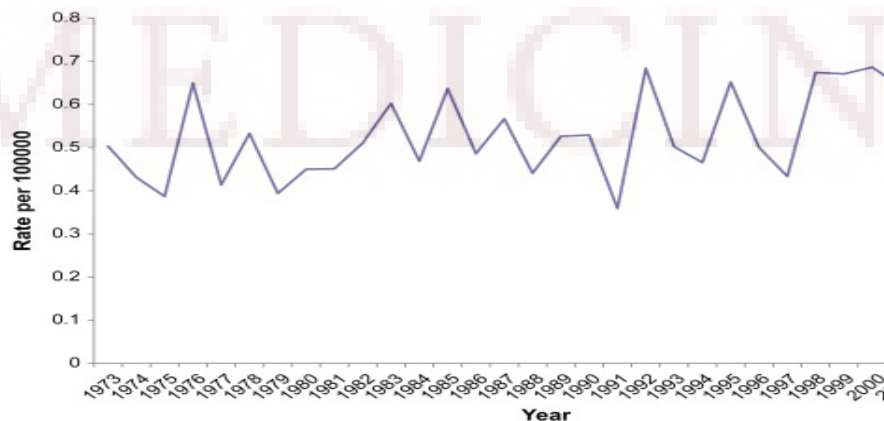
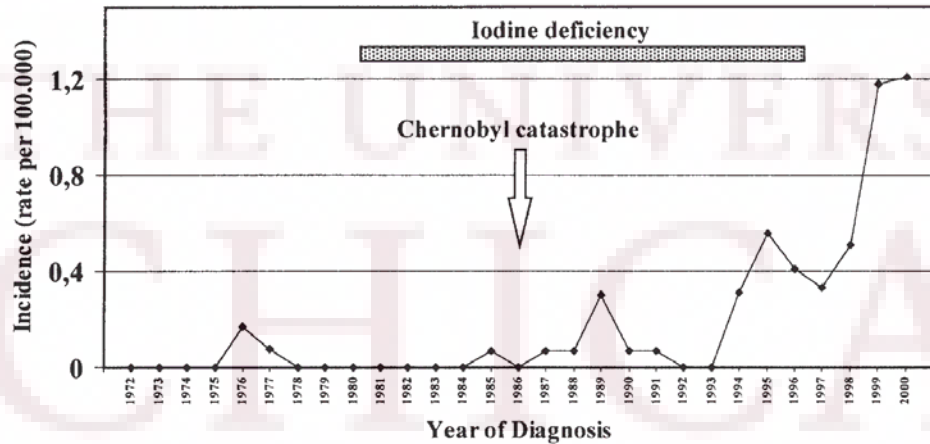
[Thyroid Cancer in Children



- Increase risk of thyroid cancer, mostly in children due to consumption of contaminated milk, small size of the gland with increased absorbed dose, and rapid cell proliferation.
- Prospective study on 411 children and adolescents with thyroid nodular disease and lived in western Poland.
 - Thyroid cancer in 9% of thyroid nodules.



Thyroid Cancer in Children



[Thyroid Cancer In Children]

- A case-control study found a strong relationship between thyroid cancer and estimated radiation dose.
 - 107 children with thyroid cancer in Minsk
 - 2 control groups:
 - Matched on age, sex, and rural/urban residence in 1986
 - Matched on pathway to diagnosis
 - I-131 dose estimated by inference from documented adult doses and regional contamination data.
 - Mean doses of radiation received were significantly higher among children with thyroid cancer (535 ± 848) than those in either control group (188 ± 386 ; 207 ± 286), $p < 0.001$; $p = 0.003$.
 - Almost a six-fold increase in risk of thyroid cancer among children who had received the highest estimated doses (1 Gy) compared with those who had received the lowest doses (< 0.30 Gy) (odds ratio (OR) = 5.84; 95% CI 1.96–17.3).

[Thyroid Cancer in Fetuses]

- Fetal thyroid begins to develop at 3rd week of gestation and starts to take up iodine at 11th week gestation.
- An Ukrainian screening study of thyroid cancer among individuals exposed in utero revealed 6 cases of thyroid cancer and 1 case of Hurthle cell neoplasm in 1494 exposed mother-child pairs and in 1 case of thyroid cancer in 1088 control pairs.
 - Estimated individual cumulative in utero thyroid dose from I-131 activity in the mother's thyroid.
 - Estimated excess odds ratio per gray was 11.66 but not statistically significant (95% CI not estimable-1982).

Gene rearrangements in radiation-induced thyroid cancer

- Rearrangements of the *ret* oncogene were investigated in PTCs from 51 Belarussian children with mean age of 3 years old at the time of the accident.
 - Compared to 16 PTCs from exposed Belarussian adults and 16 PTC from German patients without radiation history.
- 13 *ret*/PTC3 (25.5%) and 12 *ret*/PTC1 (23.5%) rearrangements were present in PTC from Belarussian children.
- *ret*/PTC1 was found in 69% of the Belarussian adult cases and only 19% in the German adult cases; no *ret*/PTC3 was found.
- *ret*/PTC3 may be typical for radiation-associated childhood PTC with a short latency period, whereas *ret*/PTC1 may be a marker for later-occurring PTC of radiation-exposed adults and children.

[Speaking of genes...]

- 15-30% of FNAs are indeterminate.
- 60-70% of thyroid cancers harbor at least one known genetic mutation.
- A gene-expression classifier that measured the expression of 167 genes was used to test 265 indeterminate nodules.
 - Correctly identified 78 of the 85 nodules as suspicious (92% sensitivity, 52% specificity).
 - Negative predictive values for “atypia (or follicular lesion) of undetermined clinical significance” was 95%, for “follicular neoplasm or lesions suspicious for follicular neoplasm” was 94%, and “suspicious cytologic findings” was 85%.

References

- Alexander et al. N Engl J Med. 2012 Aug 23;367(8):705-15.
- Astakhova et al. Radiat Res. 1998 Sep;150(3):349-56.
- Hatch et al. J Clin Endocrinol Metab. 2009 Mar;94(3):899-906.
- Hogan et al. J Surg Res. 2009 Sep;156(1):167-72.
- Niedziela et al. Pediatr Blood Cancer. 2004 Jan;42(1):84-92.
- Smida et al. Int J Cancer. 1999 Jan 5;80(1):32-8.