A Guide for Physicians

Thyroid Evaluation

of Patients Who are Concerned About Hanford Iodine-131 Releases

ATSDR

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

From 1945 through 1951, radioactive I-131 was released into the atmosphere from the Hanford Nuclear Reservation during the production of plutonium for atomic weapons. I-131 releases continued until at least 1957, although at much lower levels than before 1951. Many people residing in areas near the facility, especially those downwind, have been concerned about possible adverse health effects from this potential radiation exposure. Because iodine concentrates normally in the thyroid gland, the body organ at greatest risk for health effects from I-131 exposure is the thyroid. Although studies to date have not shown a demonstrable increase in thyroid disease in persons downwind from Hanford, many individuals remain concerned and wish to be evaluated for possible thyroid injury. What follows is information and advice to assist physicians in educating and evaluating patients who desire such screening.

General points to keep in mind when evaluating these patients

- Thyroid disease is relatively common. Therefore, careful screening of any population will detect individuals with thyroid disease.
- A finding of thyroid disease in a person who has been potentially exposed to radiation does not necessarily mean that the disease is radiation induced.
- There is no specific test or marker to determine if a thyroid disease is the result of radiation exposure rather than of other non-radiation causes.
- Thyroid evaluation is similar for persons with or without a history of radiation exposure and does not require special radiation expertise.

Basic screening consists of three elements:

1) assessing potential risk for radiation exposure, 2) palpating the thyroid gland, and 3) administering a Thyroid Stimulating Hormone (TSH) blood test. Patients requesting evaluation should be screened with these three elements.

Assessing potential risk of thyroid radiation from Hanford I-131 releases

Because I-131 has a half-life of only 8 days, the risk for I-131 radiation injury to the thyroid is limited to a relatively brief time period immediately after each release occurred. These releases were greatest in 1945, with lesser releases occurring until 1951. With knowledge of the prevailing wind patterns at the time of releases, as well as certain age, residence and milk consumption factors, the Hanford Environmental Dose Reconstruction (HEDR) study has generated thyroid dose estimates for the downwind region of Washington State. No method can determine retrospectively a specific person's exact thyroid radiation dose, but you can quickly screen patients for Hanford exposure risk by using the following map and Table 1 to determine if they might have received thyroid radiation exposure.

Evaluation of thyroid gland structure and function

Palpation of thyroid:

Look for enlargement, nodule(s), increased firmness, fixation to adjacent tissue, adjacent cervical adenopathy.

TSH:

Each lab varies slightly in their results, but most give a reference normal range of about 0.4 – 4.0 mU/L.

Basic thyroid workups:

#1 Hypo/hyper workup:

a. Elevated TSH (probable hypothyroidism): FT4, thyroid peroxidase antibody (optional).

b. Low TSH (probable hyperthyroidism): FT4, FT3, I-123 uptake and scan (to help identify type of hyperthyroidism).

#2 Nodule/goiter work-up:

May include ultrasound, fine needle aspiration (FNA) biopsy of nodule(s), and thyroid peroxidase antibody.

Screening outcomes

(refer to Table 2):

Category 1:

After thyroid palpation and TSH testing, most patients will fall into category 1. For patients in this category who have a negative exposure history, reassurance is sufficient. No further workup is necessary. However, for those in this category who have a positive exposure history, or if the patient is strongly concerned, a thyroid ultrasound is appropriate.

Category 2:

Abnormal thyroid function resulting in an abnormal TSH but without palpable changes in the thyroid gland may occur. Both hypothyroidism (elevated TSH) and hyperthyroidism (low TSH) are relatively common. Proceed with standard workup and treatment as for any patient, but with the following modification. Thyroid dysfunction

has been correlated with thyroid irradiation in other studies (but not the Hanford Thyroid Disease Study). Therefore, if patients in this category who have elevated TSH also have a positive exposure history, an ultrasound is recommended to screen for nonpalpable nodules.

Category 3:

Thyroid enlargement or nodularity with a normal TSH is a common combination. Proceed with standard workup. If a discrete solitary nodule is palpable and confirmed by ultrasound, an FNA biopsy is indicated regardless of nodule size.

When thyroid ultrasound is performed, the following are possible outcomes:

a. Normal: What appears to be a nodule by palpation may in fact be a prominent normal-variant thyroid lobulation. No cancer risk; FNA not indicated.

b. Coarse texture: A common finding in hypothyroidism and/or chronic thyroiditis. No increase in cancer risk indicated.

c. Small nodule(s) or cysts: Usually not palpable. These are a common ultrasound finding even in persons with no thyroid disease. (For example, there is an almost 50% chance of finding one or more such features in any 60-year-old woman.) They are more common among females, older adults, and people who have hypothyroidism and chronic thyroiditis. FNA of nonpalpable ultrasound nodules is indicated when they are greater than 10 mm average dimension. FNA of even smaller nodules (less than 10mm) may be indicated with positive radiation history.

d. Suspicious nodules: Solitary hypoechoic or complex nodules are more worrisome for carcinoma than are hyperechoic nodules or multinodular glands. Nodules with irregular margins or stippled internal calcifications also are more worrisome. Suspicious nodules warrant FNA.

Category 4:

These patients have evidence for both structural and functional abnormalities of the thyroid gland. Proceed with standard workup. Note comments under categories 2 & 3 above.

Treatment and/or referral of the patient:

Proceed with treatment or refer as you would any thyroid patient. Use your usual referral pathway to a thyroid or endocrine specialist. Special radiation training or expertise is not required.

Table 1. Exposure Risk from Residential History

Hanford Residence History	Exposure Risk From Hanford I-131 Releases
Patient born after 1951.	No exposure risk, regardless of residence location.
Patient born prior to 1951 but never resided in a general exposure area.	No exposure risk.
Patient resided in a general exposure area at any time during 1945-1951 a. Was age 0-4 yrs during residence* b. Back yard cow or goat as milk source c. Resided in central exposure area	Possible risk of thyroid radiation → increases exposure risk → increases exposure risk → increases exposure risk

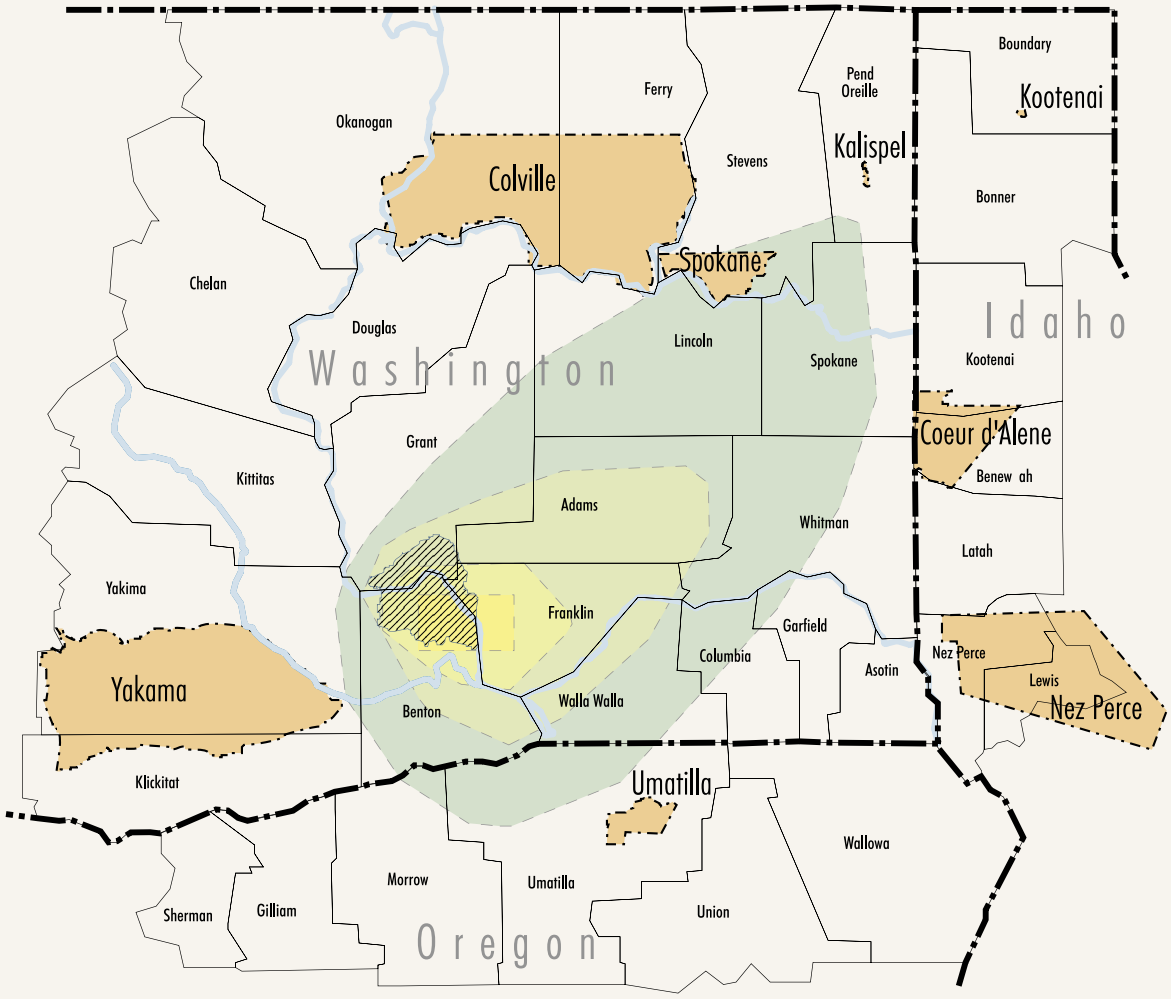
*Children older than 4 years at exposure are also at increased risk, though not as high as below age 4; adults older than 40 years at exposure are at greatly reduced risk.

Table 2. Thyroid Evaluation Guidelines

Category	Thyroid Palpation	TSH	Basic Thyroid Work-up	Comments
1	Normal	Normal	None	Reassure if no exposure. Perform ultrasound if positive exposure history exists.
2	Normal	Abnormal	Yes, see #1 above	Perform ultrasound if positive exposure history exists.
3	Abnormal	Normal	Yes, see #2 above	Perform ultrasound if positive exposure history exists. Add FNA's of nodule(s) greater than 10mm
4	Abnormal	Abnormal	Yes, see #1 & #2 above	Perform ultrasound if positive exposure history exists. Add FNA's of nodule(s) greater than 10mm

Hanford General Exposure Areas

Extent of 10-Rad I-131 Thyroid Dose to Children



0 to 4 Year Old Children - 1945

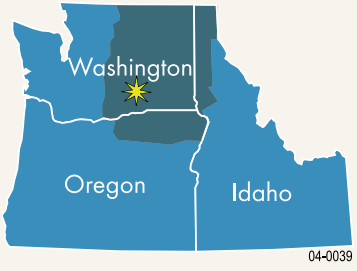
5 to 19 Year Old Children - 1945

0 to 4 Year Old Children - 1946-51 (cumulative)

5 to 19 Year Old Children - 1946-51 (cumulative)

Native American Reservation

Hanford Nuclear Reservation



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Source: HEDR Median Thyroid Dose Estimates, Centers for Disease Control and Prevention

References:

Hanford Environmental Dose Reconstruction Project, CDC, April 1994

Radiation Exposure from Iodine 131, ATSDR Case Studies in Environmental Medicine, ATSDR, November 2002 (http://www.atsdr.cdc.gov/HEC/CSEM/iodine)

Additional Resources:

Hanford Thyroid Disease Study Final Report: http://www.cdc.gov/nceh/radiation/hanford/htdsweb/

Hanford Community Health Project: www.hanfordhealth.info

American College of Preventive Medicine I-131 Webpage: www.iodine131.org

National Cancer Institute: www.cancer.gov/i131

Centers for Disease Control and Prevention: www.cdc.gov/nceh/radiation

American Thyroid Association: www.thyroid.org

American Association of Clinical Endocrinology: www.aace.com

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The content of the guide has been reviewed and endorsed by the following organizations:

AMERICAN THYROID ASSOCIATION

AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS

ACPM American College of Preventive Medicine

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