Pregnancy Testing Before High-Dose Radioiodine Treatment: A Case Report

Karl H. Bohuslavizki, Sabine Kröger, Susanne Klutmann, Martin Geiss-Tönshoff and Malte Clausen

Department of Nuclear Medicine, University Hospital Eppendorf, Hamburg, Germany

This case emphasizes that negative urine pregnancy testing and a written declaration of the patient are not sufficient to safely exclude an early pregnancy. Serum pregnancy testing inherently has a diagnostic gap of about 1 wk following conception. We recommend sufficient contraception at least 1 mo before radioiodine treatment in women of childbearing age.

Key Words: positron emission tomography; thyroid cancer; high-dose radioiodine treatment; pregnancy test

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After total thyroidectomy, including bilateral cervical lymph node dissection, a 35-y-old woman suffering from papillary thyroid cancer (pT3 N1b Mx) had high-dose radioiodine treatment. Urine pregnancy testing performed routinely in child-bearing women was negative. In addition, the patient gave her written informed consent stating that she was not pregnant.

CASE REPORT

Clinical

The patient was in good general and nutritional condition. There was no irritation of the cervical scar, and palpation of the neck revealed no enlarged cervical lymph nodes. The patient had been off thyroxine medication for 4 wk.

Laboratory Findings

Before radionuclide therapy the patient's TSH was stimulated to 64.8 mU/L (normal range = 0.3–4.0 mU/L) and free thyroid hormones in the serum were decreased: fT4 2.3 ng/L (normal range = 8.5–18.6 ng/L), fT3 < 0.4 µg/L (normal range = 0.82–1.79 µg/L). The thyroglobulin level was significantly elevated to 946 µg/L, even after a tenfold dilution of the serum.

For correspondence or reprints contact: Karl H. Bohuslavizki, MD, Dept. of Nuclear Medicine, University Hospital Eppendorf, Martinistr. 52, D-20246 Hamburg, Germany.

Ultrasonography

A hypoechoic mass with a volume of about 4 mL was found in the right thyroid bed, corresponding to postoperative thyroid remnants. In addition, a second hypoechoic mass (1.1 × 2.0 × 1.7 cm) was observed in the region of the right sternocleidomastoid muscle, corresponding to a single enlarged lymph node. The remaining neck was normal as shown by ultrasonography.

Nuclear Medicine

After the oral administration of 18 MBq (0.5 mCi) ^{131}I, an uptake of 9.3% was detected in the thyroid bed. A standard activity of 3.7 GBq (100 mCi) ^{131}I was administered for radioiodine treatment. Whole-body images acquired on the day of discharge revealed focal accumulations of radioiodine located in the right thyroid bed as well as beside the right sternocleidomastoid muscle. There was a physiological distribution of radioiodine throughout the rest of the body.

PET

Since thyroglobulin levels were persistently elevated, the patient had an additional PET study to detect the presence of noniodine-accumulating tumor tissue. Sixty minutes after the administration of 370 MBq (10 mCi) ^{18}F-FDG, whole-body emission images were acquired without correction for attenuation artifacts. PET images showed multiple pathological tracer accumulations located bilaterally in the neck, the right and left clavicular region, and the upper mediastinum. Moreover, PET revealed a single focus located in the left lower abdomen (Fig. 1). Under the assumption that it represented a recurrent ovarian cyst, the patient was referred for gynecological examination.

Further Tests

MRI performed 19 d after discharge from the hospital confirmed both thyroid remnants and metastases suspected by scintigraphy and ultrasonography. A gynecologist examined the patient 24 d after discharge. At this time, a urine pregnancy test was positive, and the gynecologist confirmed a pregnancy in the sixth week.

Therapy

The patient's pregnancy was terminated in the eighth week for 2 reasons. First, there was a potential teratogenic risk for the

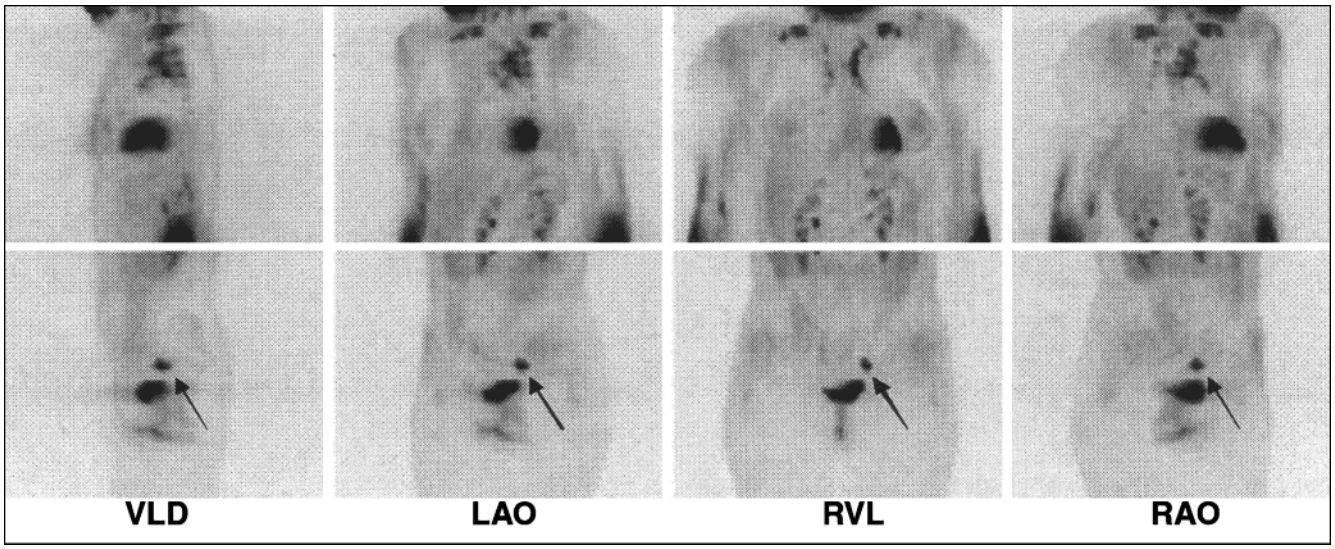

FIGURE 1. PET study 60 min after administration of 370 MBq (10 mCi) ^{18}F-FDG showing maximum intensity projections of the truncus in 4 standardized views (*9*). Note multiple pathological tracer accumulations of both sides of the neck, the upper mediastinum, and a single focus site in the left lower abdomen (arrow). Retrospectively, the latter focal tracer accumulation was determined to be the increased glucose uptake of a fetus.

embryo. Second, due to the stage of thyroid cancer (pT3 N1b Mx) at diagnosis, further high-dose radioiodine treatment was necessary for complete ablation of thyroid tissues.

DISCUSSION

Routine urine pregnancy testing is performed on all women of child-bearing age before the administration of radioiodine. Patients are requested to affirm that they are not pregnant at the time of signature in a standardized written consent form.

Beta-HCG can be detected in the urine beginning with the first or second day after the lack of the expected menstruation. In principle there is a diagnostic gap in urine pregnancy testing. In other words, there is a time interval between conception and the detection of β-HCG in the urine. Assuming a regular 28-d cycle, urine pregnancy testing becomes true-positive from 15 to 16 d after conception. In contrast, β-HCG can be detected in blood samples as early as 7 to 8 d after conception since the serum concentration of β-HCG is significantly higher than its urine concentration (*1–4*). Serum pregnancy testing becomes true-positive as early as 1 wk after conception. In principle, even serum pregnancy testing has a diagnostic gap of about 7 d, which is the time interval between conception and the detection of β-HCG in blood samples.

In this case, the radiation burden to the embryo was caused both from high-dose radioiodine treatment and from PET. The absorbed dose in the uterus was calculated to be at least 0.2 Gy from the 3.7 GBq (100 mCi) ^{131}I treatment and another 0.01 Gy from the 370 MBq (10 mCi) ^{18}F-FDG used for PET (*5,6*). The absorbed dose to the uterus probably was even higher than calculated (*7,8*) due to an increased blood supply in pregnancy with corresponding higher ^{18}F-FDG uptake.

This pregnancy was terminated in accordance with the patient's wish for 2 reasons. First, there was a significant teratogenic risk due to the absorbed dose of at least 0.2 Gy to the uterus/embryo. Second, this patient's papillary thyroid cancer was presenting with multiple radioiodine-trapping metastases, radioiodine-avid thyroid remnants in the thyroid bed, and massively elevated thyroglobulin levels required additional sessions of high-dose radioiodine treatment.

Since serum pregnancy testing has an inherent diagnostic gap of about 1 wk from conception, we recommend sufficient contraception for at least 1 mo before radioiodine treatment in women of childbearing age.

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